

MACHINERY

Design—Construction—Operation

Volume 42

APRIL, 1936

Number 8

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 568-C

Now — Cast-Iron Die-Castings! The production of iron castings in steel dies by the application of air pressure is today an actual fact. It is being done by a process that constitutes a remarkable achievement in metallurgy and engineering—a development that may be of great importance to industry. The leading article in May MACHINERY will give—for the first time—complete details of this new process.

Automotive Industry Points Way to National Progress <i>By William S. Knudsen</i>	489
New Materials and New Methods in Lincoln-Zephyr Manufacture— <i>By Charles O. Herb</i>	492
Broaching Applied to Pressed-Steel Front Axles	497
Ingenious Devices Used in Producing the Packard Transmission	498
Recent Applications of Cemented Carbide in Automotive Production	500
Management and Employee Cooperation in Chrysler Plants <i>By K. T. Keller</i>	503
High-Frequency Tools Speed up Chevrolet Assembly Line	506
Sparks Fly from 1600 Welders in Building Ford V-Eights	510
Broadening Use of the Coining Process	514
Adapting Present Equipment to Changed Requirements <i>By W. D. Averill</i>	518
Speeding Automotive Production by Operations on Mult-Automatics	522
Milling Cylinder Blocks by the Rigidmil Automatic Process	524
Precision Thread Grinding As a Manufacturing Process <i>By Ira J. Snader</i>	528
Buick's Modernization Program Effects Forge Shop Economies	532
Plymouth Flywheels—44 an Hour	534
Grinding Universal-Joint Crosses	535
Editorial Comment	536
A Great Industry that Retains Its Leadership—Overhead Should Not be a Fixed Percentage of Labor Cost	

DEPARTMENTS

Ingenious Mechanical Movements	537
Materials of Industry	540
Questions and Answers	542
New Trade Literature	543
Shop Equipment News	545
News of the Industry	568

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS *President*
EDGAR A. BECKER *Vice-pres. and Treasurer*
ERIK OBERG *Editor*
FRANKLIN D. JONES *Associate Editor*
CHARLES O. HERB *Associate Editor*
FREEMAN C. DUSTON *Associate Editor*

LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, \$3 (two years, \$5); foreign countries, \$6. Single copies, 35 cents. Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue. Send old as well as new address.

Copyright 1936 by The Industrial Press. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Member of A.B.P. Member of A.B.C.

Product Index 212-228
Advertisers Index 231-232

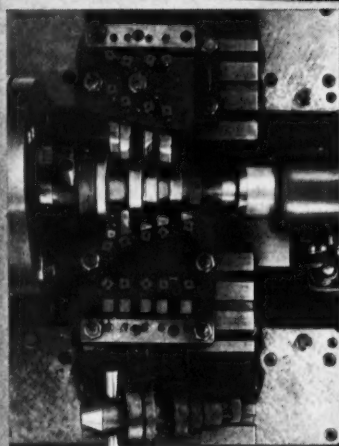
CIRCULATION 15,203

Of Course We'll Show You Mean to

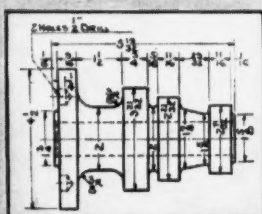
NO. 1
DUOMATIC



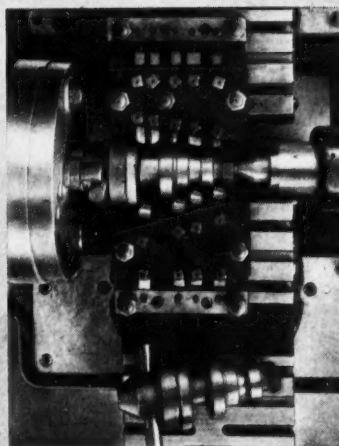
Pictures and working drawings—speak louder than words. Here are 10 typical examples of Duomatic application on automobile parts. Consider them from the standpoint of simplified and increased production on multi-operation work and you will see how Duomatic installations have reduced costs.



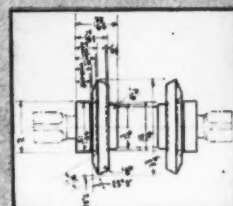
AUTOMOBILE
CLUSTER GEAR



ROUGHING
FINISHING

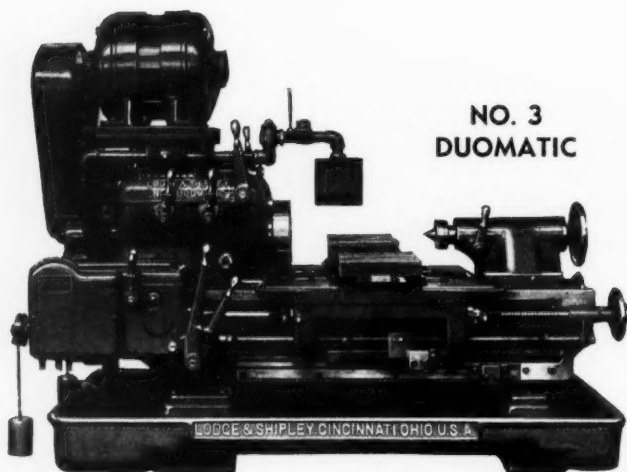


DOUBLE BEVEL GEAR



DUOMATIC—The Auto by LODGE

NO. 3
DUOMATIC



NO. 5
DUOMATIC

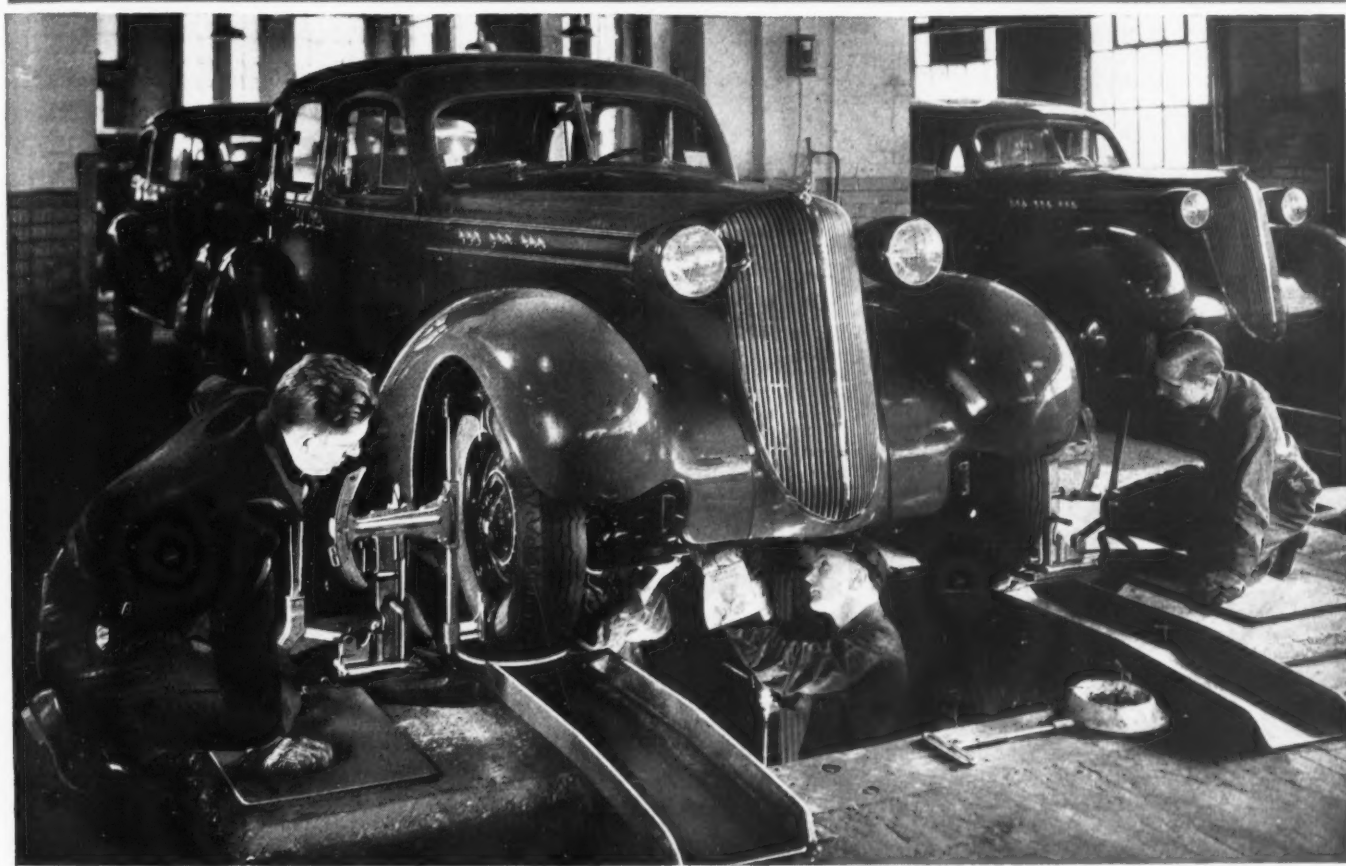


MACHINERY

Volume 42

NEW YORK, APRIL, 1936

Number 8



Automotive Industry Points Way to National Progress

By William S. Knudsen

*Executive Vice-President
General Motors Corporation*



THE automobile industry completed the year 1935 with a production exceeded only by three other years in its history. This is significant, because the depression reduced the sale of automobiles to a point where it was believed by many that we had reached a stalemate in production and would have to be satisfied with a controlled output from then on. Happily, the engineers and production men in the industry solved the problem of furnishing better automobiles at lower cost, and in this way made the public conscious of the obsolescence factor in their present cars.

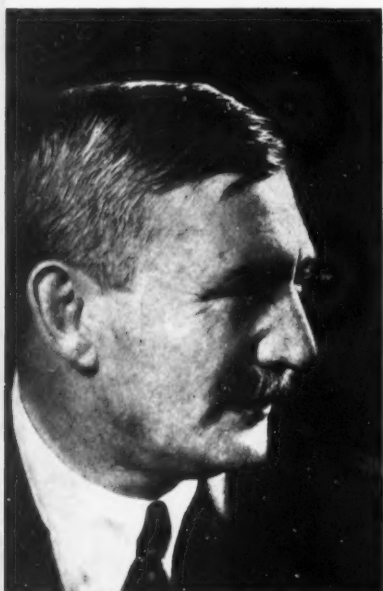


THE AUTOMOTIVE INDUSTRY

>

>

>



William S. Knudsen

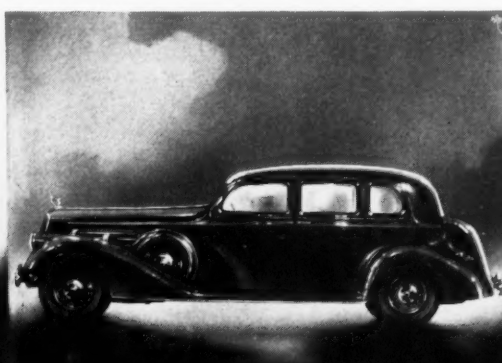
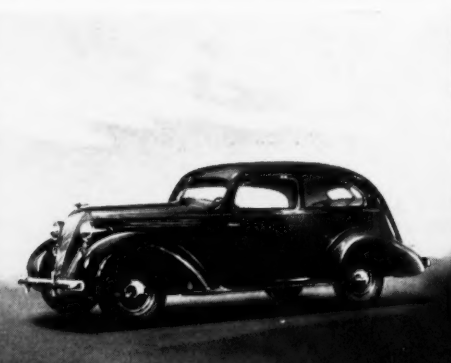
FIRST, the designers were able to make a product more attractive in appearance. Second, the engineers and tool designers provided the means by which the new designs could be manufactured in quantity at low cost. And third, the machine tool builders helped the automobile manufacturer in every way to produce more accurate work with better tools.

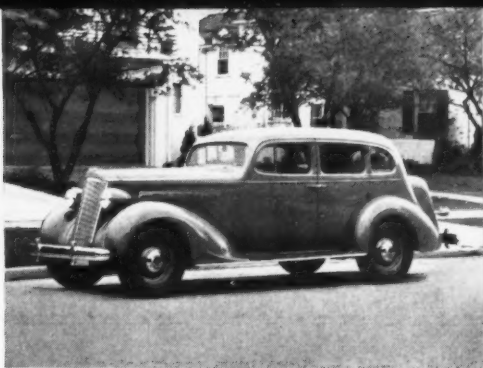
THIS cooperation of all concerned is responsible for the gratifying results achieved. In comparing the automobiles of today with those of even five years ago, performance, economy, and comfort stand out all along the line; and at the same time, the per-pound cost of the automobile has been reduced to where today it is given to the customer at about twenty-one cents a pound. Mechanical men who understand what is required to produce a

good automobile will recognize that this cost is very low, and can be achieved only by volume of production and efficiency in plant operation.

INDUSTRY at large has profited in other directions as well by the progress of the automobile industry. The cooperative work of automobile production engineers and machine tool builders has made possible many advances in machine tool operation that are of far-reaching benefit in all machinery industries. It was a revelation to visit the recent Machine Tool Show in Cleveland and to see how aggressively and energetically the machine tool industry had tackled the problem of aiding all machine tool using plants to produce at lower costs. Entirely new methods were revealed, and neither money nor time had been spared in producing results that spelled better production.

THIS, I think, argues well for the future of American industry and should forever dispose of the fallacious argument so often heard that improved machinery creates unemployment.





>

>

>

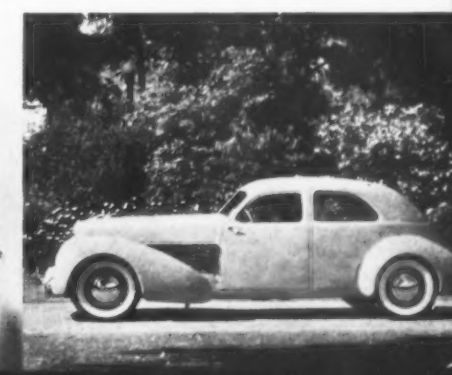
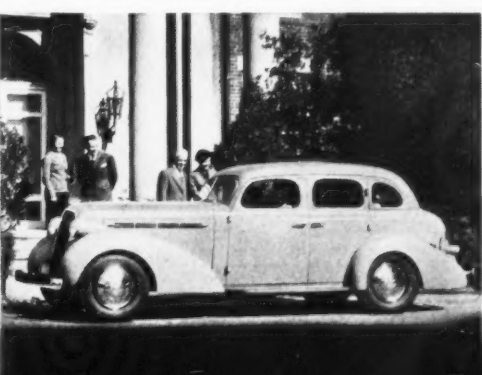
LEADS IN NATIONAL PROGRESS

DEPRESSIONS are caused by numerous economic conditions which produce valleys in the employment curve, but no one has ever been able to demonstrate satisfactorily that technological advances produce "technological unemployment." The automobile industry stands today close to an all-time peak for employment. The benefits of the automobile have been great and manifold, but perhaps the greatest of all is due to the fact that it has opened the radius of every man's employment area. Today a man can accept work ten, twenty, thirty miles from his home, and travel back and forth comfortably, whereas formerly five or six miles constituted the limit. The technological advances made in other industries during the last ten years have also been passed on to the public, and the result is that practically every American home is a better place to live in, and the possibilities of raising the standard of living have been tremendously increased.

IF America resumes its place as the leading manufacturer in the world market, many of our difficulties will be solved. That

means that America becomes again the first agricultural producer in the world market, and that some of the old trading ability which helped to build this country will again begin to function. We can produce food in abundance. We have the metals. We have nearly all of the raw materials. We have men willing to work. Surely, there must be some way in which the fullest measure of benefit from this combination can be obtained.

AMERICAN industry has been a symbol of American democracy. In industry, each man advances to the extent that his ability enables him to advance. Industry asks no odds — simply the privilege of working out its own problems in the best possible way. Work and thrift will place any country on its feet. Sound social measures, carefully worked out and gradually put into effect, will aid in improving the standard of living; but without work at good wages there is no foundation on which to build. To centralize industry is to go backward; to unduly regulate industry will stifle progress, and in the end prove unworkable.



New Materials and New Methods

STRIKINGLY new ideas in automobile appearance and engineering were displayed with the introduction of the Lincoln-Zephyr last autumn by the Lincoln Motor Co., Detroit, Mich. This car is of distinctly streamline design, with a center of gravity only 14 inches above the road. Running boards, being unnecessary because of the low design of the car, have been replaced with narrow rubber-covered buffers, the sole function of which is to protect the sides of the car. The absence of running boards gives increased roominess within the car.

The greatest difference between the Lincoln-Zephyr and other American automobiles, however, lies in the fact that it is constructed without the conventional chassis or chassis frame. The body is an all-steel welded unit of "bridge truss" construction, and the axle assemblies, engine, etc., are attached directly to the body frame. The body panels are part of the load carrying structure, thus providing strength with light weight. Assembly is greatly facilitated by this design, the final assembly line for this car being the shortest in the world.

New materials also are used in manufacturing the various working parts of this automobile. For instance, the pistons are alloy steel castings, with a finished wall thickness of only about $1/32$ inch; the camshafts are cast from an iron alloy; the crankshafts are a cast-steel alloy; the valve push-rods are iron alloy castings; and the valves are made of chromium steel. This article will describe

Ford has Entered the Medium-Price Field of Automobiles with a Car of Distinctive Appearance and Unusual Engineering Design. It is the Only Car Produced in America without the Conventional Chassis

some of the unusual methods employed in producing a "car that is different."

The cast steel alloy pistons represent the latest development of Ford metallurgy. Unusual wearing qualities are claimed for the new material. When the pistons are finished, their wall thickness must be between 0.030 and 0.035 inch, and the weight must be between 334 and 337 grams (11.78 and 11.89 ounces). Think of an allowable weight variation of only 0.11 ounce—actually less than the weight of a letter size sheet of paper!

The pistons are first turned, and faced on the dome end while chucked from the inside in a lathe. About 0.010 inch of stock is left on the diameter for finishing by grinding. The grinding is performed in three steps, as care must be taken to see that the pistons do not become heated so much as to cause distortion—an occurrence that might easily happen on account of the extremely thin walls.

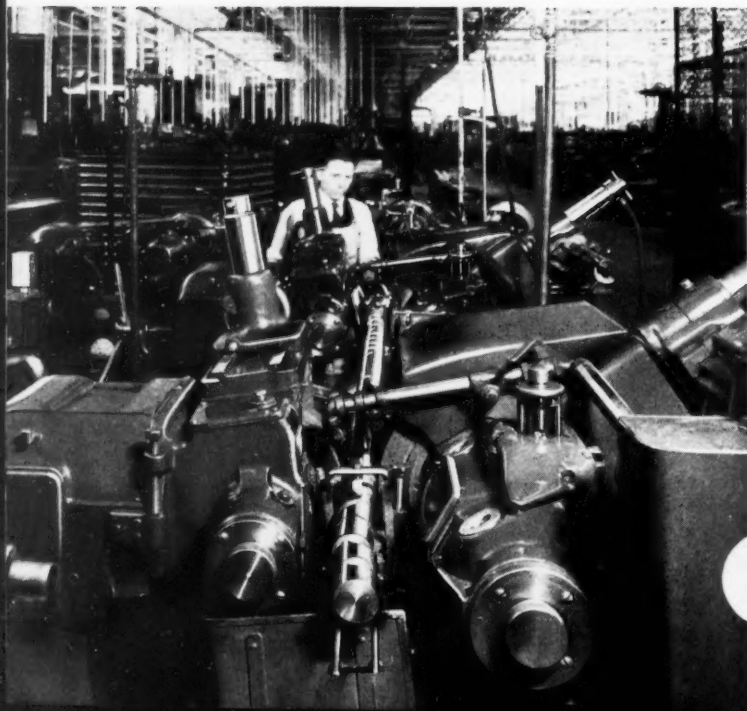


Fig. 1. Lincoln-Zephyr Pistons are Alloy Steel Castings that Have a Wall Thickness of Only About $1/32$ Inch after Being Ground in Centerless Machines. Grinding is Performed in Three Steps to Avoid Excessive Heating of the Thin Piston Walls

in Lincoln-Zephyr Manufacture

Castings of Iron and Steel Alloys are Used for the Crankshaft, Camshaft, Cylinder Block, Valve Push-Rods, and Even the Pistons. Their Adoption Called for New Machining Methods *By Charles O. Herb*

The grinding is performed in Cincinnati centerless machines. Two of these machines are arranged as shown in Fig. 1, the pistons sliding on a track directly from one machine to the next. The final diameter of the pistons is from 2.747 to 2.7475 inches.

After the pistons have been finish-ground, they pass to the machine shown in Fig. 2 to be corrected for weight. The piston is slipped into a cylindrical bushing and placed on arm A, which is connected to the weighing mechanism of a scale made by the Toledo Precision Devices Co., Toledo, Ohio. The weight of each individual piston, therefore, determines its vertical position in the weight correcting machine.

When a push-button is depressed to start this machine, the movable jaw B of the clamp moves from the right to secure the piston between it and the stationary jaw. End-mill C then feeds upward

a predetermined amount for removing stock from the open end of the piston. The amount of stock taken off depends, of course, upon the relative height of the piston on arm A. In other words, the end-mill always moves upward the same distance but the bottom ends of the pistons are not necessarily in the same positions. This weight correcting machine was built by the Morris Machine Tool Co., Cincinnati, Ohio.

The Ford Motor Co. has found that camshafts cast from an iron alloy wear better than steel forgings; the longer the iron alloy camshafts are in service, the harder the cam surfaces become. In addition, the cast camshafts can be produced more cheaply, and straightening to correct deflection during machining is not required. A cast camshaft will break before it becomes deflected. The camshafts average 321 in Brinell hardness.

Grinding is the first machining operation on the cast camshafts, as turning is unnecessary. Before the grinding, however, each camshaft is tested for strength, as shown in Fig. 3, by dropping a weight of 3 1/2 pounds from a height of 36 inches on it.

About 0.010 inch on the diameter is ground from the cam surfaces and bearings. Rough-, semi-finish, and finish-grinding operations are performed. The camshaft then comes to the Norton multiple-wheel machine shown in Fig. 5, which grinds off any high spots on the faces of the cams and bearings to insure that the wrong push-rod will not be actuated by any cam. The nine grinding wheels take care

Fig. 2. Each Piston Must Be of the Specified Weight within 3 Grams, which is Only About One-tenth of an Ounce. The Machine Illustrated Automatically Weighs and Corrects the Pistons, an End-mill Removing the Required Amount of Stock

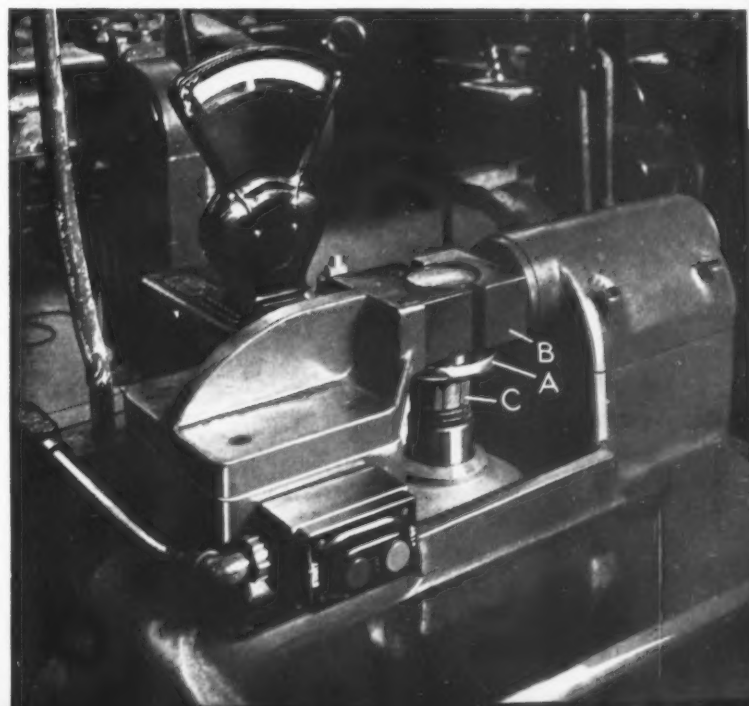
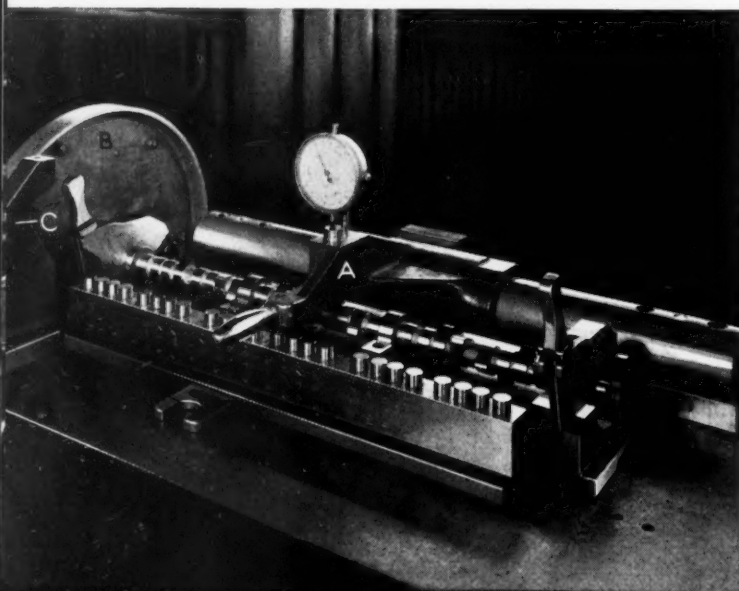




Fig. 3. The Cast Alloy Iron Camshafts are Checked for Strength by Dropping a 3 1/2-pound Weight from a Height of 3 Feet—a Simple Inspection Method that has Proved Entirely Satisfactory



Fig. 4. Inspection Fixture Designed for Checking the Opening and Closing Points of the Twenty-four Cams on the Camshaft. Every One of the Cams Must be True in Thickness to 0.0005 Inch



of eighteen camshaft faces at one time. As there are fifty-four faces on the camshaft, the wheels are applied three times to each piece.

An inspection fixture for checking the opening and closing points of each cam in relation to the distributor slot is illustrated in Fig. 4. Directly opposite each cam is an accurate button, on which a button attached to handle *A* rests in checking the cam. When the camshaft is revolved by turning the large wheel *B*, the thickness of the cam at the desired points is checked by observing the dial indicator as the proper graduations on wheel *B* register with a scribed line on upright *C*. The cams must be true in thickness within 0.0005 inch. The graduations on wheel *B* are at a radius of 9 inches from the center, whereas the surfaces being checked have radii of 7/8 inch or less. The construction of the inspection fixture therefore insures extreme accuracy.

Crankshafts cast from a high-carbon, high-copper, chromium-silicon steel have been adopted for the Lincoln-Zephyr because of their satisfactory performance in Ford automobiles. This alloy has been found to possess unusual fatigue properties. It has a higher tensile strength than forged steel crankshafts, and it has a hardness of from 280 to 324 Brinell. In addition, the cast crankshafts are more easily manufactured than the steel forgings. Also, the straightening operation generally required after the machining of a steel forged crankshaft is eliminated with a cast crankshaft.

After the bearings and pins have been ground to size, the crankshafts are tested for static and dynamic balance in the electric spark type of machine built by the Tinius Olsen Testing Machine Co., Philadelphia, Pa. This equipment, which is shown in Fig. 6, indicates the amount and angular location of unbalance in both ends of a crankshaft with one setting. The crankshafts are revolved at about 300 revolutions per minute in this inspection. The construction and operation of this type of balancing machine have been previously described in *MACHINERY*.

About ninety crankshafts can be checked hourly with this equipment. Corrections are made by drilling. The balance of crankshafts corrected with the aid of this machine has been verified in a machine of the "wiggler" type, which is so sensitive that the least bit of vibration in a crankshaft will cause electric sparks.

The engine of the Lincoln-Zephyr is of the V-type and has twelve cylinders. Three boring oper-

ations are performed on the cylinders and they are then precision-bored in the Barnes machine shown in Fig. 7, which is equipped with Ex-Cell-O boring heads. Six cylinders (three on each side) are bored at a time, an engine block being completed with every second cycle of the machine. Tungsten-carbide tools are used to bore the cylinders within 0.001 inch of the finished size, and straight and round within 0.0005 inch. The cylinder bores are $2\frac{3}{4}$ inches nominal diameter by approximately 8 inches in length. The tool-spindles revolve at about 550 revolutions per minute. Because of the accuracy and high degree of finish obtained in the precision boring operation, reaming and rough-honing are eliminated. The engine blocks go directly from the precision boring machine to the finish-honing operation.

Two connecting-rods are precision-bored simultaneously in the bronze-bushed small ends by means of the Heald Bore-Matic, illustrated in Fig. 8. Single-point tungsten-carbide tools are used. The connecting-rods are accurately positioned for this operation by means of centers which engage conical holes in the large and small bosses. One center of each pair floats endwise, but is positively backed up when handle A is tightened.

When the machine is started to feed the work fixture toward the boring spindles, clamps B are automatically pulled against the connecting-rods to grip them firmly. The bushings are bored in this operation to from 0.7503 to 0.7506 inch, the tolerance being only 0.0003 inch. The large end of the connecting-rods is split at an angle instead of straight across, as in the ordinary manner, this being necessary in order to pass the rods through the comparatively small cylinder bores during the assembly of the engine.

The various parts of the engine are manufactured in lines that lead directly to the motor block assembly line. Overhead conveyors bring the smaller parts to the assemblers. Above this assembly line extend I-beams which are fitted with trolleys from which various electrical tools are suspended, such as nut-setters, screwdrivers, and drills. The motor assembly line is about 160 feet long.

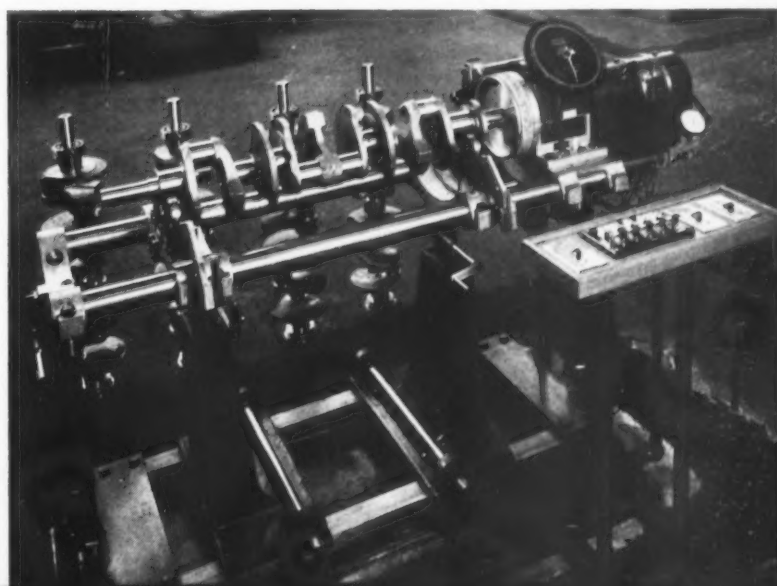
The all-steel bodies are fabricated at the LeBaron plant of the Briggs Mfg. Co., Detroit, Mich., and reach the Lincoln plant unpainted and without fenders or interior trimmings. Over four thousand welds are made in fabricating the bodies. The tools, dies, and welding machines installed for



Fig. 5. Grinding Machine Equipped with Nine Wheels for Removing Any High Spots on the Fifty-four Faces of Camshafts. Eighteen Camshaft Faces are Corrected at One Time



Fig. 6. Crankshafts are Checked for the Amount and Angular Location of Unbalance in an Electric Spark Type of Balancing Machine. Approximately Ninety Crankshafts are Checked Hourly



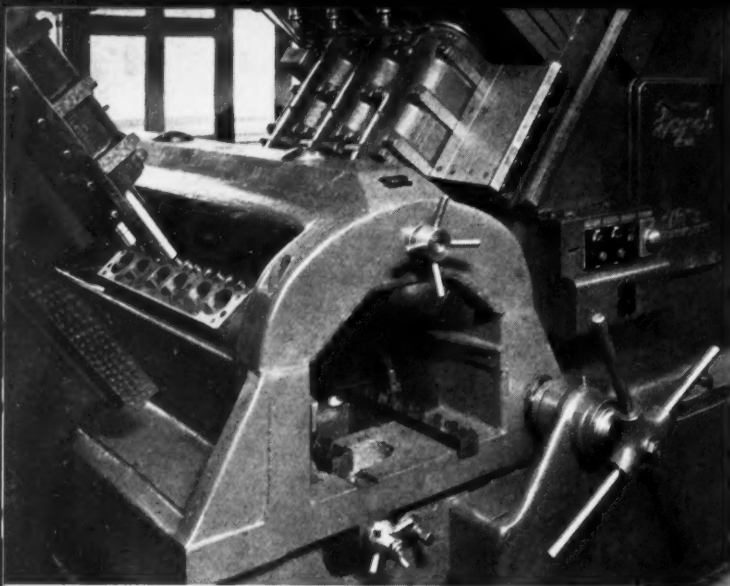


Fig. 7. (Above) Precision-boring Cylinders with Tungsten-carbide Tools. Fig. 8. (Below) Precision-boring Bushing in Small End of Connecting-rods

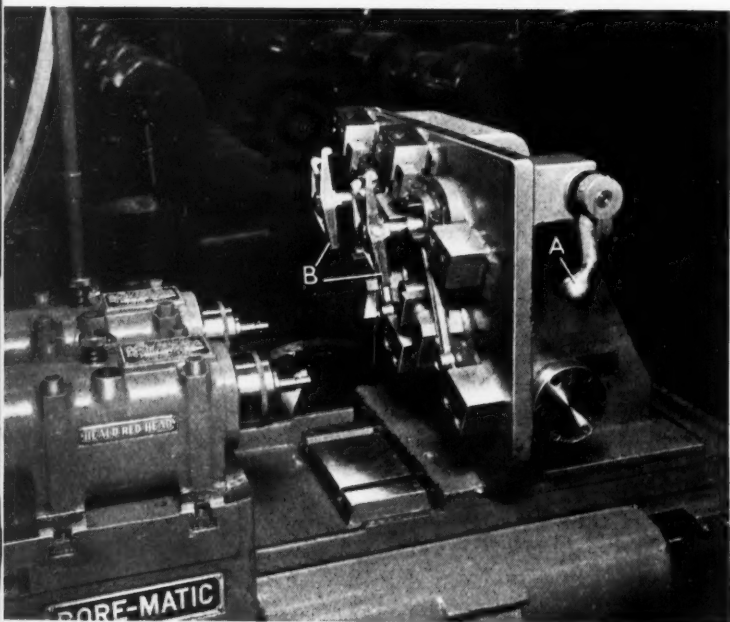
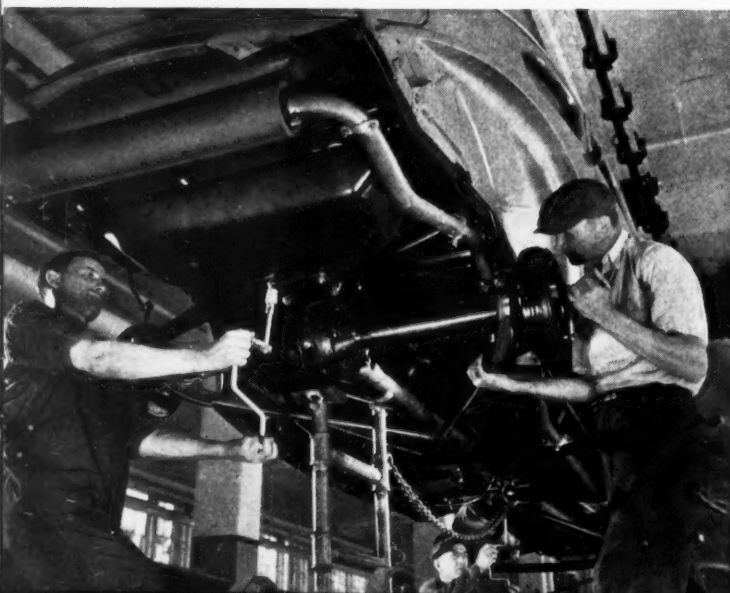


Fig. 9. (Below) Since the Lincoln-Zephyr Has No Chassis, the Front and Rear Axles are Assembled from Below



the production of the bodies alone represent an expenditure of over one and a half million dollars.

When the bodies, fenders, radiator shells, etc., reach the Lincoln plant, they pass through a series of cleaning, painting, and drying operations performed with equipment planned to provide the utmost convenience, health-protection, and efficiency. Ten hours are required for a body, fender, or radiator shell to go through the painting department. The details of these operations will be described in an article to be published in a coming number of **MACHINERY**.

When the bodies leave the painting department, Mortell body deadener is sprayed on the doors, cowl sides, and various other parts. Inside trimmings, such as the instrument panel, rear-vision mirror and seats are next installed. Then the body is transferred to storage until it is required at the final assembly line on the floor below.

The bodies are delivered to this assembly line by an overhead conveyor. The front and rear axle assemblies are first attached to the under side of the body, as shown in Fig. 9, while supported on three-wheeled trucks equipped with mechanical lifting devices. The body is then lowered to a floor type conveyor, and as it proceeds along, the motor is inserted into the hood from overhead, and the fenders, wheels, and other parts are attached. Because of the fact that the running gear and engine are fastened directly to the body rather than to a chassis, and because the various sub-assemblies are completed in the departments in which they are produced, this assembly line is only 350 feet long. It is believed to be the shortest in the world. The conveyor moves at a speed of 4 feet 3 inches a minute.



According to *Industrial Britain*, automotive brakes that adjust themselves automatically as wear takes place have been developed by engineers of the Birmingham (England) Corporation Omnibus Department. It is said that this development makes brake adjustment by hand unnecessary throughout the life of the brake linings. All wear is automatically taken up and a constant clearance is maintained, the apparatus adjusting itself to quite minute evidences of wear. An important feature also claimed is that the correct brake adjustment is maintained on each wheel, irrespective of any variation in the rate of wear of the different brake linings.

Broaching Applied to Pressed-Steel Front Axles

An Operation Which Shows That Broaching is Applicable to Fabricated Pieces as Well as to Forgings and Castings

BROACHING is commonly employed for finishing forgings and castings of solid or fairly heavy cross-section. That this machining method is not confined to those classes of work, however, will be apparent from Figs. 1 and 2, which show equipment built for broaching broad flat surfaces on the ends of an automobile front axle that is fabricated from steel stampings welded together. The surfaces broached are uppermost in Fig. 2; they fit against frame members when assembled in an automobile. Broaches 3 inches wide by 26 inches long are employed in the operation. The broaching machine and its equipment were built by the Colonial Broach Co., Detroit, Mich.

The important problem in designing the broaching equipment for this job was to provide adequate support for the work. Each end of the work is seated in a U-shaped jaw A. When the fixture is operated to swing the work through 90 degrees into position for the broaching operation, stationary blocks, one of which can be seen at B, clamp the piece firmly in the U-shaped jaws. In addition, wedge-shaped clamps are automatically forced against the axle at both ends.

The fixture is air-operated. It will be seen in Fig. 2 that the working members at the two ends of the fixture are connected by a coupling C that has sufficient play to insure independent clamping of the two ends of the work. The U-shaped work-holders are operated through toggles.

The operation of the machine can be effected by moving a lever on either side. Both rams are moved in unison in the same direction by hydraulic power. The production is 120 axles an hour.

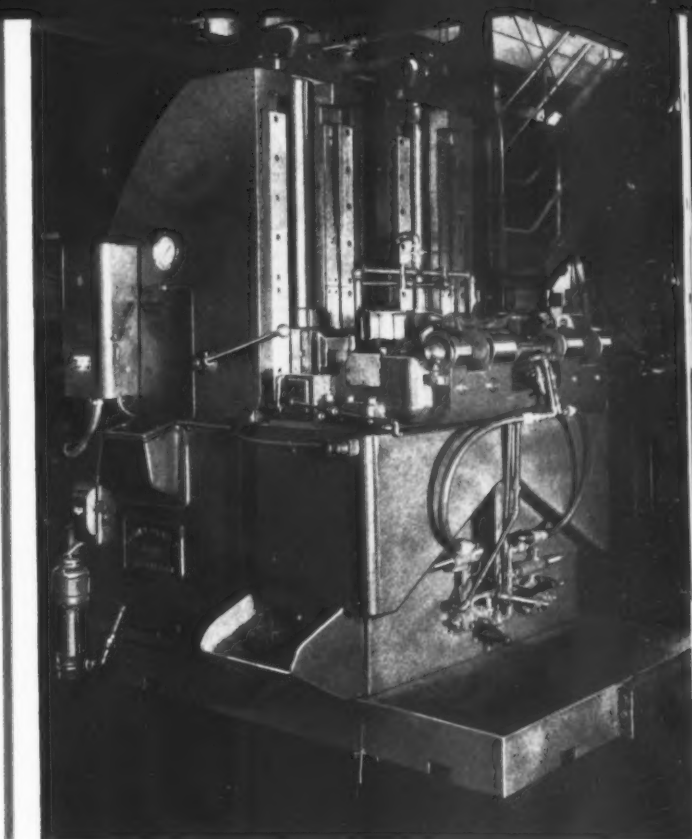
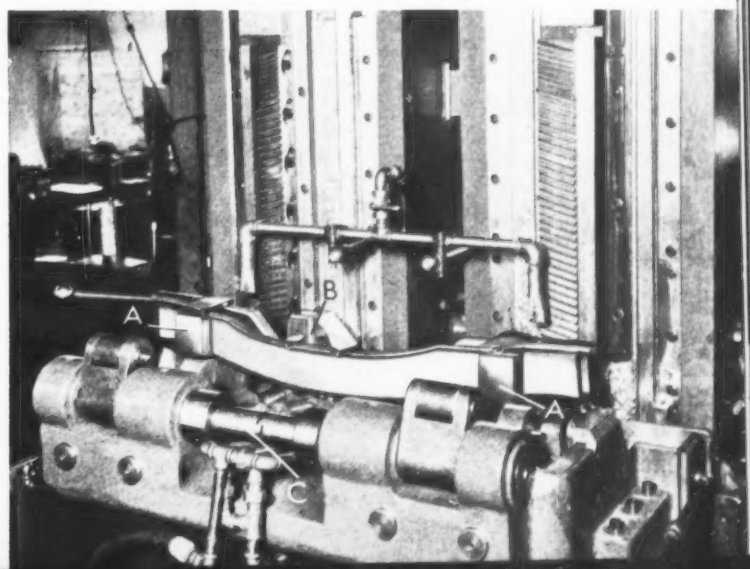


Fig. 1. Heavy Duplex Type of Hydraulic Broaching Machine Arranged for Finishing Opposite Ends of Pressed-steel Automobile Front Axles



Fig. 2. An Air-operated Fixture Swings the Front Axle 90 Degrees into the Working Position and Back Again for Unloading



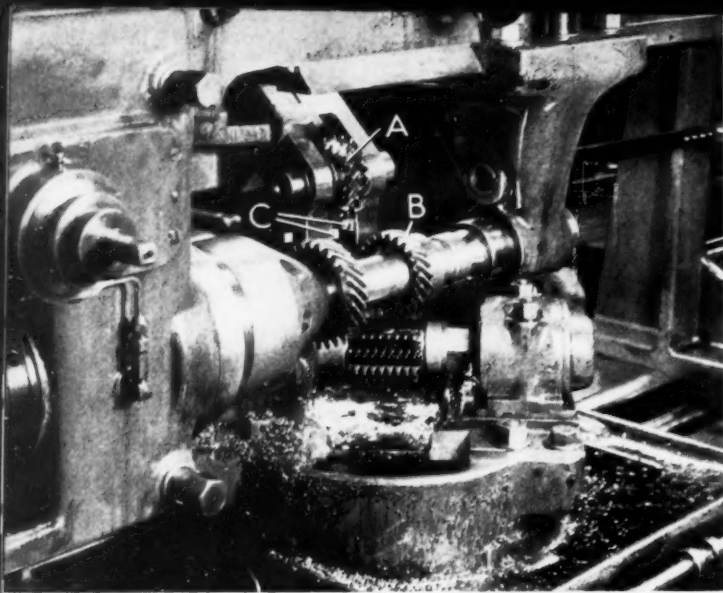
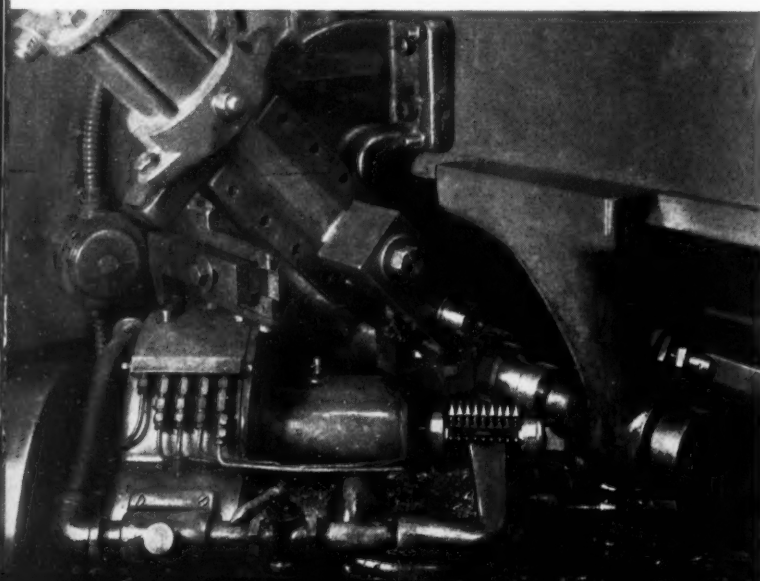


Fig. 1. An Automatic Burring Attachment for the Packard 120 Transmission Gears Applied to a Barber - Colman Gear - hobbing Machine



Fig. 2. Rear View of the Burring Attachment Illustrated in Fig. 1, Showing the Slide on which it is Mounted in the Operating Position



Ingenious Devices the Packard

IN the cutting and finishing of the transmission gears for the Packard 120 model, several unusual devices and methods are used. Figs. 1 and 2 show an arrangement used in the Packard plant at Detroit, Mich., for burring gears, cut on a gear-hobbing machine, by means of an attachment mounted directly on the machine. Usually the burring is done by a hand-filing operation after the gears have been removed from the hobbing machine. This procedure is expensive and does not give uniformly satisfactory results.

In the method illustrated, when the hobbing operation is nearly completed, a slide holding the burring tools moves forward. Then a roller *A* (Fig. 1) having teeth at each end corresponding to those of the gear *B* being burred engages the gear and rolls the burr down and out toward the outer sides of the gear. After this operation, shaving tools *C*, mounted on the same slide beneath the roller, shave off the burrs projecting from the sides of the gear. The action of the burring attachment is entirely automatic and is synchronized with the hobbing operation.

Between the teeth in the rolling tool, and on a slightly smaller pitch diameter, are cut teeth, on the surface of which are fine grooves like those of a knurl. Owing to the difference in pitch diameter of this roller and the gear being hobbled, these tooth surfaces have a different speed from those of the teeth in the gear with which they mate, and hence there is a shaving action across the width of the tooth, which removes any fine burrs that may be left on the tooth surface itself.

The same principle is employed in connection with Fellows machines, except that here the burring attachment is an independent fixture not synchronized with the gear-cutting operation.

This method has proved superior to either burring by filing by hand or to burring in a punch press with an indexing fixture. It has been found that a perfectly burred gear results, and furthermore, the advantage of an automatic rather than a hand operation is secured.

An interesting attachment for pointing transmission gear teeth by a single-point revolving cutter is used in the Packard plant, as shown in Fig. 3.

Used in Producing Transmission

The single-point rotary cutter in the foreground is geared to synchronize its motion with that of the gear being pointed, which is driven as indicated. As the single-point cutter rotates, it shaves off the corners of the teeth, pointing them to the required shape. This fixture makes it possible to point the teeth of four gears a minute.

Fig. 4 shows a battery of lapping machines used for lapping all of the transmission gears of the Packard 120 model. By the arrangement here shown, production has been increased from eight to from twenty-four to twenty-six gears an hour. These gears are made from a nickel-alloy steel, carburized and hardened.

In addition to the savings effected by the increased production, the machines shown cost but a fraction of the price of those formerly used for this operation; and the cost of the laps has been reduced to one-fourth of the cost of those previously employed. These savings make it practicable to use gears lapped to a high degree of accuracy in a medium-priced car.

The laps used are made from chilled cast iron. They are cast around a high-speed steel hardened master gear. No machining or finishing of the teeth of the lap is necessary. The lap is simply put into the machine and "broken in" by the preliminary lapping of one or two gears that are later relapped and used in regular production. Means are provided for clamping the lap in the hollow bowl in the base of the machine beneath the spindle.

The gear to be lapped is placed on the end of the machine spindle and held by a simple clamping device, no regular arbor being required. The lapping spindle is provided with a vertical up and down motion as well as with a helical motion corresponding to the helix of the gear being lapped. While lapping, the gear is entirely submerged in the emery compound.

No trouble has been met with in the upkeep of these machines, since no moving parts come in contact with the grinding compound. An interesting feature of the operation is the use of compressed air to agitate the compound at the bottom of the receptacle in the base, in order to prevent it from settling or hardening into a compact mass.



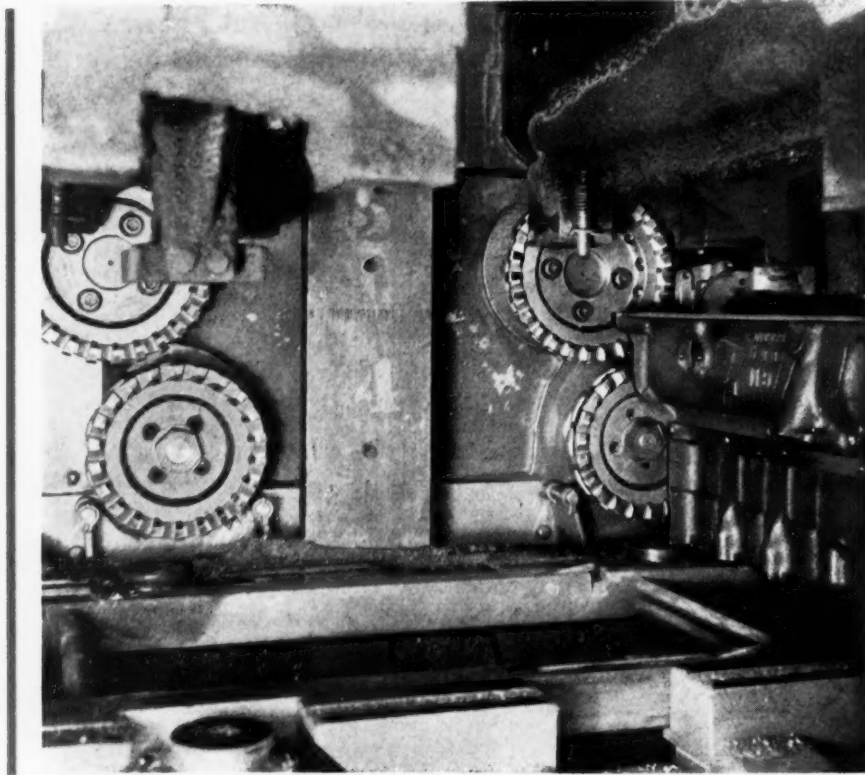
Fig. 3. Attachment for Pointing Teeth of Packard Transmission Gears by a Single-point Revolving Cutter which is Synchronized with the Gear



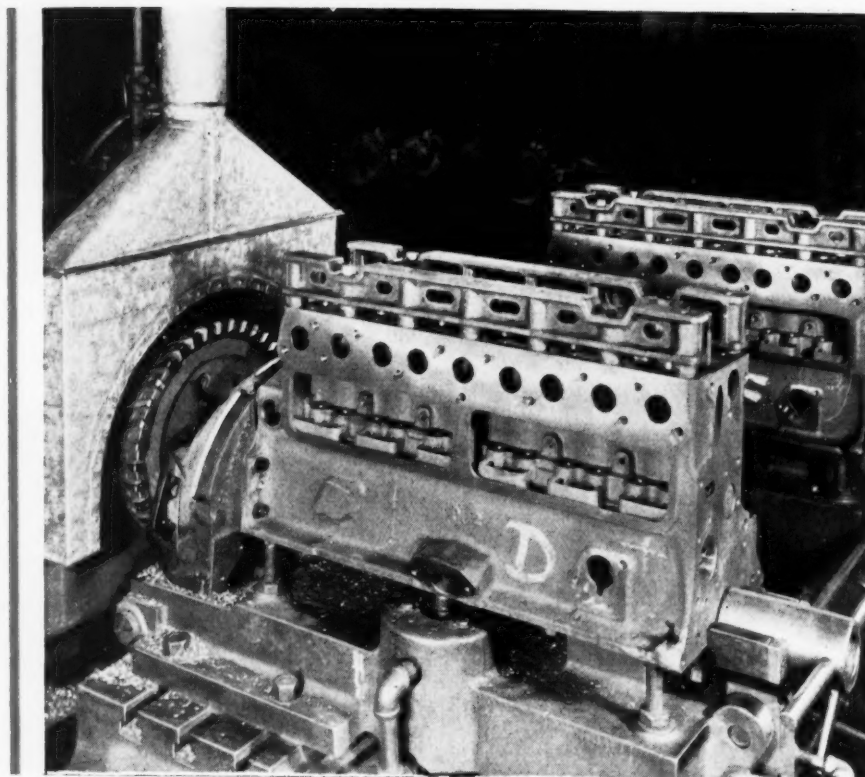
Fig. 4. A Battery of Transmission Gear Lapping Machines, Lapping Gears for the Packard 120 Model at the Rate of About 25 an Hour



Recent Applications of Cemented



Rough- and Finish-milling Front End of Chevrolet Cylinder Blocks on a Sandstrand Machine. Using Cemented-carbide Tools. Cutting Speed, 150 Feet per Minute; Feed, 16 Inches per Minute; Depth of Cut, 3/16 Inch; Production per Hour, 110 Cylinder Blocks; Pieces per Grind, 6000 Roughing, 10,000 Finishing

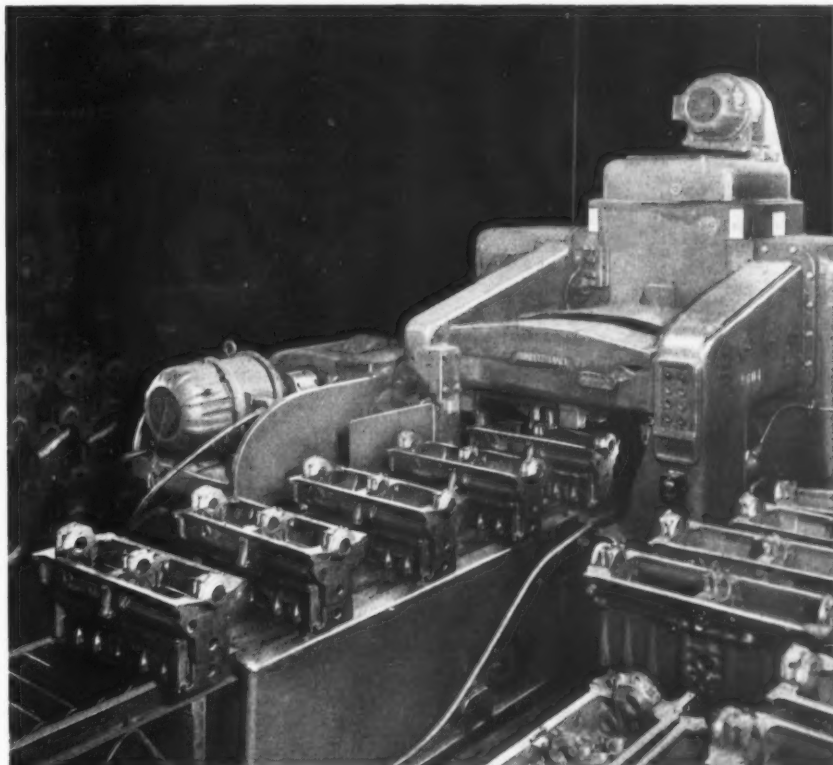


Milling Clutch Housing on Plymouth Cylinder Blocks on a Cincinnati Hydromatic. Cutting Speed, 50 Revolutions per Minute; Feed, 12 1/2 Inches per Minute; Depth of Cut, 1/32 Inch; Production per Hour, 60; Pieces per Grind, 6720 (Previously Used Tools Gave 480 Pieces per Grind)

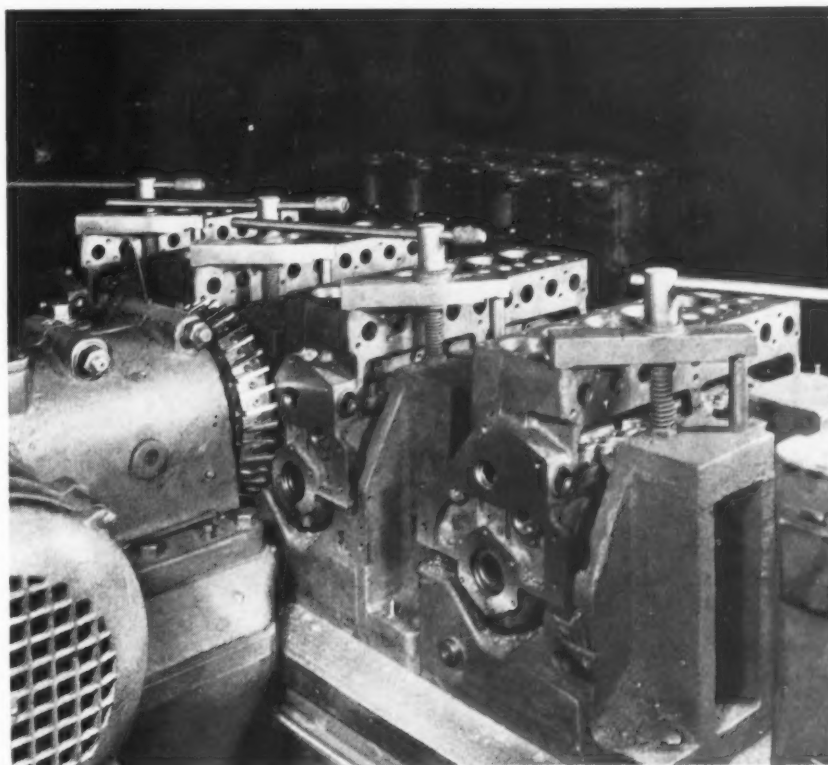
Carbide in Automotive Production

Photos, Courtesy Carboloy Co., Inc.

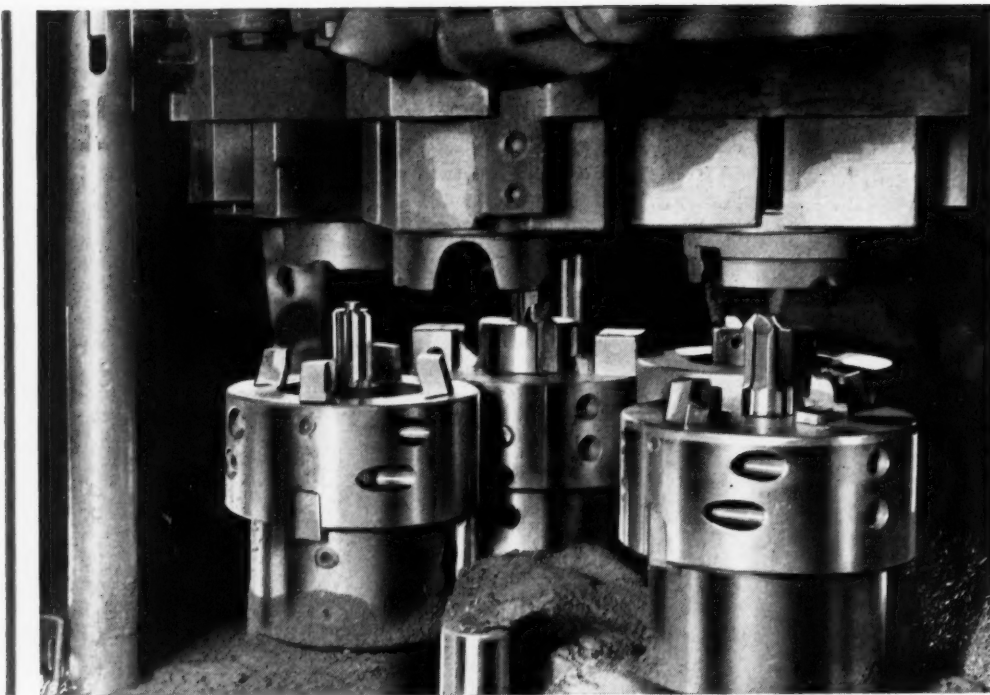
Set-up for Rough- and Finish-milling Front End of Chevrolet Cylinder Blocks on a Sundstrand Special Milling Machine, a Close-up View of the Cutter Arrangement being Shown on the Opposite Page. Note the Conveyor Arrangement at End of Table of Machine and Continuous Feed through Machine



Finish-milling Rear End of Plymouth Cylinder Blocks on a Consolidated Milling Machine Using Cemented-carbide Tools. Cutting Speed, 12 Revolutions per Minute; Feed, 16 Inches per Minute; Depth of Cut, 0.015 Inch; Production per Hour, 44 Cylinder Blocks; Number of Pieces Produced per Grind, 3168

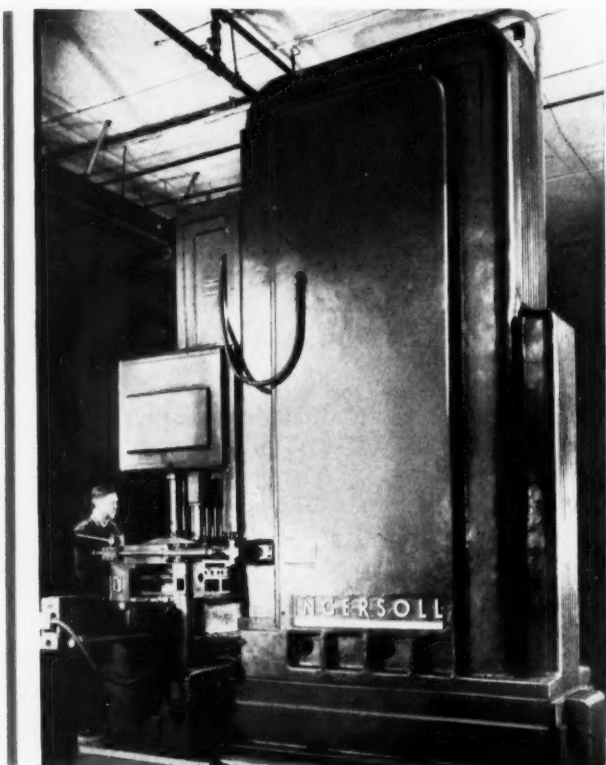


Photos, Courtesy Carboloy Co., Inc.

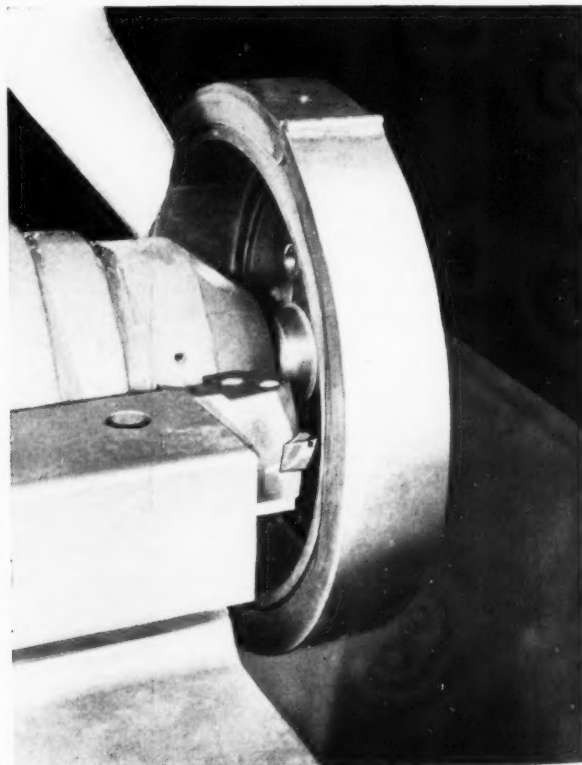


Rough-turning, Facing, Boring and Chamfering a Cast-iron Distributor Housing at the Holley Carburetor Co. on a Goss & De Leeuw Machine, Using 13 Cemented-carbide Tools to the Set-up. Cutting Speed, 240 R. P. M.; Feed, 0.016 Inch; Depth of Cut, 1/16 Inch; Production, 300 per Hour; Pieces per Grind, 24,000

Finish-boring Packard 120 Cylinder Blocks on an Ingersoll Sixteen-spindle Vertical Power Pack, Using Cemented-carbide Tools. Depth of Bore, 7 7/8 Inches; Depth of Cut, 1/32 Inch; Time Required for Operation, 45 Seconds; Number of Cylinder Blocks per Grind of Tools, 100



Finish-boring Cast-iron and Steel Brake-drums for the Plymouth Car on a Sundstrand Machine. Cutting Speed, Cast Iron, 160 R.P.M.; Steel, 140 R.P.M. Feed, Cast Iron, 1 1/4 Inches per Minute; Steel, 1 Inch per Minute. Production per Hour, Cast Iron, 70; Steel, 55 to 60



Management and Employee Cooperation in Chrysler Plants

Confidence in the Fairness of the Company's Employees when Fairly Dealt with is the Basis of the Success of the Chrysler Corporation's Industrial Relations Methods

By K. T. KELLER
President, Chrysler Corporation

TRAINED and efficient men and women, backed by good materials, modern equipment, and sound and adequate finances, are necessary to make a good product. The highest degree of efficiency and economy is reached when hearts and minds are in tune with jobs. In fact, the quality of the product is influenced by the conditions under which the employees do their work.

The fundamental basis of cooperation between management and employees is mutual respect and understanding. The aim of the management of the Chrysler Corporation is to develop a stable organization, well trained by experience, and willing to cooperate with the management in its efforts to give the public increasingly better values.

During 1935, the Chrysler Corporation produced and shipped some 840,000 cars and trucks. This was the greatest output in the history of the business. To me it indicates two things of importance to all of us: First, that the public has an increasingly high regard for our products; and second, that the way to safeguard the prestige of these products—which is our job—is to put into them the most careful and conscientious work of which we are capable.

As the employees know, the wage rates we have paid are even higher than the 1929 level. We are endeavoring in every practical way to offset the effects of the seasonal character of the automobile business upon the stability of employment. It is



our hope that still further improvement can be accomplished, notwithstanding the practical difficulties due to wide fluctuations in the demand for automobiles, not only at different times of the year, but also from one year to another.

Now, what are the essentials of a satisfactory relationship between the company and its employees? Perhaps I can best answer that question by reciting some of the important elements in the Chrysler Corporation's relations with its employees.

In the first place, provision is made to insure, in so far as economic conditions permit, steady jobs at fair wages, under safe physical working conditions. I have just referred to stabilizing employment. The Chrysler Corporation has pioneered in these efforts. Safe working conditions are the subject of continuous study on the part of those responsible for production, assisted by men specially trained in making jobs safe; and of even greater importance, the full cooperation of the em-

ployees themselves in observing ordinary caution and following safety instructions intelligently and willingly has been secured. We have gone one step farther in the establishment of what is known as the Chrysler Industrial Hygiene Laboratories, the interest of which is healthfulness of working conditions. In this study of industrial health hazards, the Chrysler Corporation is one of only three or four institutions in the United States that have approached the subject in such a systematic way.

*Employees, through their Own Association,
Provide their Own Social Services*

Perhaps next in order is the provision made for employees and their families to protect themselves against sickness and accident. An organization called the Chrysler Industrial Association has been instituted, which is made up of the employees and is operated and maintained by them for their own benefit. One of its functions is the administration of life, sickness, and accident insurance, which more than 95 per cent of all the employees carry. This insurance covers all accidents outside of employment, as well as sickness and death. The State Compensation Law covers accidents and death occurring from or arising out of employment.

In addition to administering insurance, the Chrysler Industrial Association carries on a variety of activities in the interest of employees. In times of need, assistance is rendered in the form of food orders, clothing, fuel, medical aid, X-ray examinations, visiting nurses, loans, financial advice, and at Christmas baskets of food and stockings of toys. In case of death, the Association sends flowers and burial assistance is given. Such other services are rendered as arranging for the payment of electric light, water, and gas bills, free barber service, the delivery of daily papers to those confined in hospitals, etc. All such work is, of course, subject to careful investigation; naturally few cases are exactly alike, and therefore are not treated alike. It is interesting to note, in respect to the work of the Chrysler Industrial Association, that during the depression, no employee of the Chrysler Corporation had to go on the relief rolls of the city of Detroit. The Association found ways to help those in need.

The Association also renders assistance to employees and their families in financial and other emergencies in which professional advice may be helpful. Last year from 300 to 500 loans were made by the Association, totalling about \$17,000 and averaging about \$40 per loan. At Christmas time 2000 baskets of food were distributed among

children who otherwise would not have had a Christmas dinner.

Money is raised for these activities largely through the operation of thirty retail stores which are maintained in the plants of the Corporation and operated exclusively by and for the employees. They are in no sense of the word "company" stores. The profits derived from the sale of candy, tobacco, cigars, cigarettes, gloves, fruit, aprons, gum, soft drinks, milk, soap, ice cream, etc., are used to support the work of the Chrysler Industrial Association. Additional sums are secured from time to time either by donations or from the assistance of benefits, bridge parties, and dances.

The Chrysler Corporation provides and maintains the space and equipment required by the stores and the offices of the Industrial Association without charge. It also pays the salaries of many of the men in the Association. It furnishes and maintains the cars required. It provides, equips, and maintains the athletic fields which the Association uses; outfits the members of the Chrysler Choir; pays the expenses of publishing a monthly magazine for the Association; and pays part of the premiums for the insurance. It does not profit in any way from the operation of the stores or from money raised by the Association other ways.

*Chrysler Corporation Maintains Schools
for Engineering and Business Training*

The Corporation endeavors also to provide opportunities for employees to better their position in the company, a problem to which all industry is paying increasing attention. To this end, as well as to provide a reservoir of promising material for advanced positions throughout the organization, the Chrysler Institute of Engineering was established. It consists of a Graduate School for advanced work in theoretical and engineering practice, an Undergraduate School for less advanced work, a School of Business Administration, and a School of Business Training. At the present time there are nearly 1000 men and women enrolled in these schools. Of no less importance are the foremen's training courses which are conducted for the purpose of familiarizing the foremen with management policies and helping them to carry on more effectively and understandingly their supervisory duties.

Perhaps the most important element in the relations between the management and the employees in the plants of the Chrysler Corporation is the Works Council plan of collective bargaining, first inaugurated in October, 1933. This plan provides

a procedure whereby the employees, through duly elected representatives, confer with management representatives concerning matters affecting working conditions. This plan is also designed to promote harmonious working relations and mutual understanding.

The Purposes of the Works Council Plan and How it is Operated

The purposes of this plan are mainly as follows:

1. To provide a two-way channel of communication between management and men.
2. To provide procedure for the prompt handling of grievances.
3. To provide a method of collective negotiation on the terms of employment.
4. To provide an educational medium for both employees and management, to foster better understanding of their respective problems.

Employee members of the Works Council are nominated and elected by the employees by secret ballot. Voting districts are determined so as to include substantially an equal number of shop employees, and with due regard to geographical and departmental classification. Regular nominations and elections are conducted annually. Special elections are held when it becomes necessary. All elections are conducted so as to avoid interference with the voters and to prevent any fraud in the casting or counting of the ballots. An employee representative may be recalled from office by a petition signed by one-half of the voters in his district. When a vacancy in the office of employee representative occurs in any plant, the remaining employee representatives in the plant conduct an election to fill the vacancy.

Any matter which, in the opinion of any employee, requires adjustment, and which such employee is unable to adjust with the foreman in charge of the work on which he is employed, may be referred by the employee to the employee representative of his voting district. The employee representative then endeavors to reach a satisfactory settlement of the matter with the foreman. If they are unable to agree, they, in consultation with the management special representative, prepare a joint statement of the matter to be taken up with the foreman's superiors. If the matter cannot be satisfactorily settled in this way, it may, with the approval of the employee concerned, be referred to the Works Council. The Works Council may call any employee before it to give information regarding the matter under consideration.

When the plan was originally submitted to the

employees by Mr. Chrysler, a secret ballot was taken in all plants to permit the employees to decide whether or not they wanted to adopt it. Eighty-six per cent of the employees voted in favor of the plan. This balloting and the succeeding nominations and elections were conducted under the direction of the Chrysler Industrial Association.

The first joint council meetings were held in October, 1933, and regular monthly meetings have been held since. The last annual elections of employee representatives were held late in January of this year. These were arranged entirely by the employee representatives in office, who through their Works Council nominated an election committee to handle the election machinery. The working force reports for the Detroit plants on the day of nominations indicated that there were 46,072 eligible to vote. Of these some 42,776, or 93 per cent, cast ballots.

Quoting Mr. Chrysler on How to Promote Friendly Understanding and Confidence

In presenting the works council plan to the employees in October, 1933, Mr. Chrysler said: "As a former shop-worker I have long looked forward to the time when the employees and the management of the Chrysler Corporation would sit down around a table to discuss and decide matters of mutual interest to all of us.

"I have always believed that if we could do this in a spirit of friendly understanding and confidence in each other, we would accomplish a great step forward in promoting the kind of relationship we all want in this industry.

"It is inevitable, in a large organization such as this, that from time to time questions should arise. The aim should be to provide a mutually satisfactory method of dealing with these matters, of jointly establishing what the facts are, and then, jointly, in a friendly, cooperative way decide what we are going to do about them.

"I have enough confidence in the fairness of men to believe that when they know the facts and have a voice in deciding matters that concern them they will come to decisions that are fair and reasonable.

"The whole purpose of the plan is to promote such a relationship in our plants as will insure the employees a square deal and encourage their willing cooperation in advancing the company whose interests concern every one of us."

That is the spirit in which the management of the Chrysler Corporation seeks to conduct all its relations with its employees.

High-Frequency Tools Speed

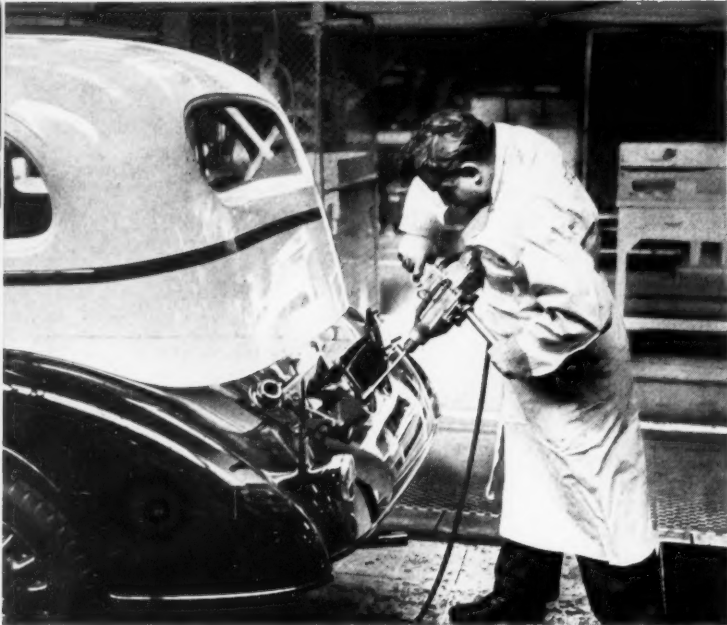
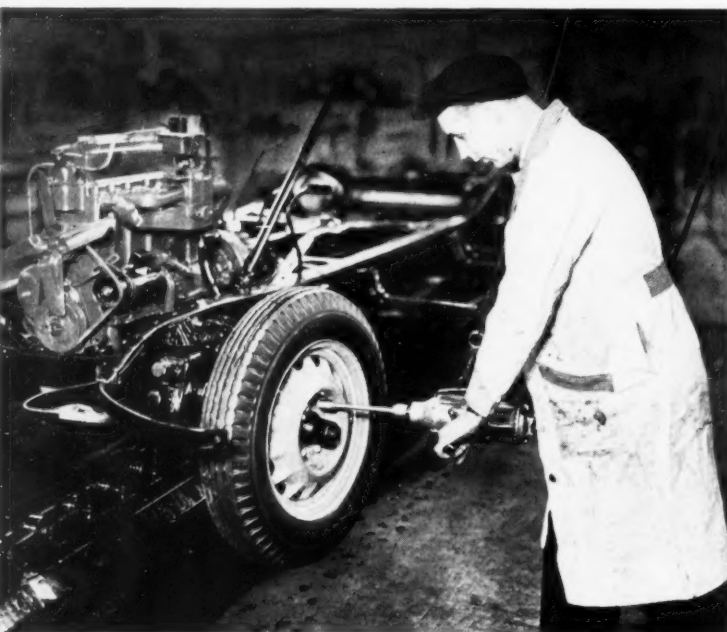


Fig. 1. High-frequency Portable Electric Tools have been Widely Adopted for Assembly Operations in Automobile Plants since Their Development Ten Years Ago

Fig. 2. It Takes Only About Three Seconds to Drive a Wheel Nut Tight with This High-frequency Electric Nut-runner



Portable Electric Tools of the High-Frequency Type were Developed for the Production Shop Because of the Desirable Features of the 180-Cycle Squirrel-Cage Induction Type of Motor

ONE year ago this month, the Baltimore, Md., plant of the Chevrolet Motor Co. began assembling cars and trucks. The latest of the company's assembly plants, it is fitted throughout with the most modern equipment for the assembly of automobiles. From fifty to sixty cars can be completed each hour with approximately 250 men on an assembly line 800 feet long.

High-frequency portable electric tools are used exclusively on the assembly and sub-assembly lines for nut-running, screwdriving, drilling, tapping, grinding, sanding, and polishing. All together, there are over 400 high-frequency tools. These tools are hung from small trolleys which operate on overhead monorail tracks. Electric contact is made between the rollers on the trolleys and the bus bars on the inside of the monorail tracks. By suspending the tools from trolleys, they can be conveniently applied as the car assemblies progress along the line. The larger high-frequency tools are suspended from balancing devices which connect the tools with the trolleys, thus relieving the operators of the weight of the tools.

Portable electric tools of the universal type are used in this plant for maintenance purposes only.

The power delivered by portable electric tools depends mainly upon the torque of the motors. The motor built into high-frequency tools operates on three-phase alternating current of 180 cycles, 220 volts, which gives a no-load speed of 10,800 revolutions per minute. The drop in speed of a high-frequency motor between no load and the pull-out point is only 20 per cent, while the corresponding speed drop on other types of motors is approximately 60 per cent.

The high-frequency motor maintains its speed to a relatively high degree under load, an advantage

Up Chevrolet Assembly Line

High-Frequency Tools Bring Important Advantages to Quantity-Production Plants Using a Sufficient Number of Portable Tools to Warrant Installation of Frequency Changing Equipment

that enables work to be done fast and uniformly throughout the day. This characteristic is especially advantageous on abrasive work, because uniform speed is required for maximum grinding efficiency. It is also of advantage in the case of high-speed nut-runners, such as shown in Fig. 2. With tools of this kind, six 7/16-inch nuts which hold the automobile wheel to the hub assembly are driven tight at the rate of 3 seconds apiece.

In using a tool of this type, the wrench socket does not revolve until it has been placed over the nut and sufficient pressure is applied to automatically engage a clutch. When the nut has been driven tight, the clutch is automatically disengaged. Nut-runners are operated at speeds of between 500 and 1000 revolutions per minute.

High-frequency tools are of extremely simple construction, and for this reason maintenance costs are reasonably low. The high-frequency motor has no brushes, brush-holders, sliding contacts, or electrical connections between the stator and the rotor. Because of the simplicity of construction, a great many ordinary motor troubles are eliminated. Safety of operation is also enhanced by the motor construction, because there is no opportunity for arcing between a commutator and brushes.

The rotor is made with squirrel-cage winding consisting of copper bars extended through slots in stampings. Short-circuiting rings are riveted to the copper bars and the various joints are welded or brazed. The rotor is practically indestructible; it has no wire windings that might loosen and fly outward.

Electric current of 180 cycles, three-phase, 220 volts cannot be obtained direct from central power stations, and therefore, whenever high-frequency tools are to be used, it is necessary to change the



Fig. 3. With Right-angle Nut-runners and Screwdrivers Many Nuts and Screws can be Tightened by Power instead of being Slowly Driven by Hand

Fig. 4. Using a High-frequency Portable Electric Nut-runner on the Under Side of a Car, the Operator Standing in a Pit



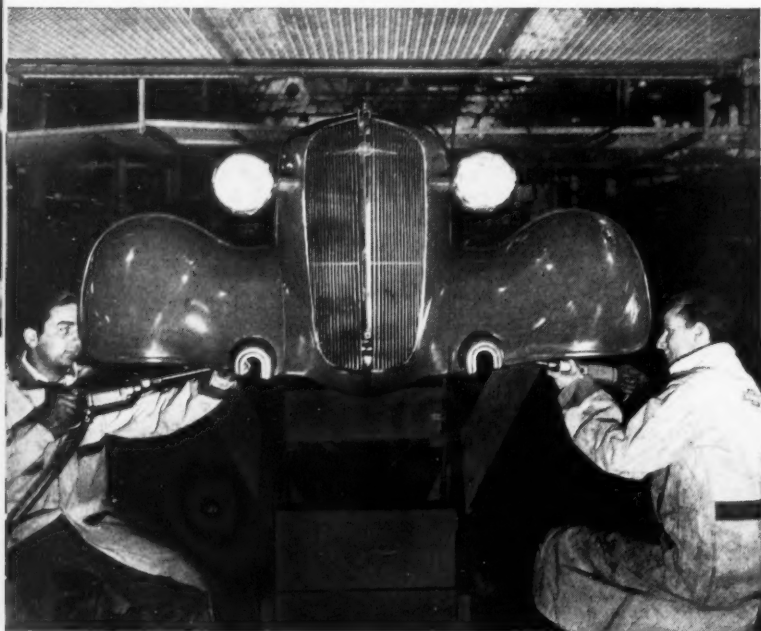
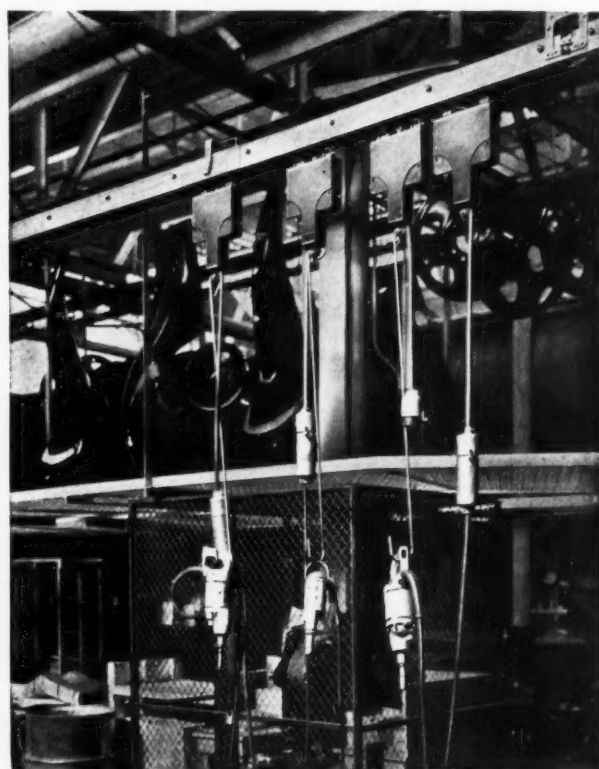


Fig. 5. High-frequency Portable Electric Tools have been Found Particularly Useful in Production Work Because They Maintain Their Speed and Power under Load to a Relatively High Degree

Fig. 6. (Below) Right-angle Tool Being Used for Polishing Painted Sheet-metal Surface with a Lamb's-wool Pad, Fig. 7. (Right) The High-frequency Portable Electric Tools along the Assembly Line are Suspended from Small Trolleys that Run on Overhead Tracks



frequency of the available current or else generate the necessary current. The type of frequency changer generally used consists of a driving motor connected to a wound rotor induction motor in which the winding is so proportioned that when the motor is driven backward at twice its normal speed in the forward direction, current of 180 cycles, 220 volts can be taken off the rotor slip rings. When direct current only is available, it is necessary to actually generate 180-cycle, 220-volt current with a motor-generator set. In the Chevrolet plant, one frequency changer provides suitable current for all high-frequency tool requirements.



Owing to the necessity of changing or producing electrical current in the industrial plant where high-frequency tools are used, the installation costs are generally too great for a small number of tools. When only a few tools are used in a plant, the universal type of portable electric tool is, therefore, more economical, although there are exceptions to this rule in some particular applications.

Nut-runners and screwdrivers are the principal high-frequency tools employed on the main assembly line in the Chevrolet plant, although there are also some drills and tappers. Grinders, sanders, and buffers are used on sub-assembly lines. Fig. 3

shows the application of a right-angle tool in a case where the nut to be driven would be inaccessible with a standard type of nut-runner and difficult to drive by hand.

Body bolts are being driven tight on the under side of automobiles by the operator shown in Fig. 4 who works in a pit as the cars are carried past

overhead by the main assembly conveyor. Fig. 5 shows the application of high-frequency screw-drivers equipped with extra-length bits or sockets, on the radiator and fender sub-assembly. Fig. 6 shows a type of tool employed for polishing with lamb's-wool pads. The method of suspending tools from overhead tracks is illustrated in Fig. 7.

Special Pneumatic Hammers Make Riveting a One-Man Job

CONSIDERABLE riveting is performed in airplane plants in fabricating the various airplane members which are constructed of aluminum alloys. The Curtiss Aeroplane & Motor Co., Inc., Buffalo, N. Y., has effected large economies in the riveting operations by the development of pneumatic hammers having an integral anvil. Hammers of this type make riveting a one-man job, as they eliminate the necessity of a helper for backing up the rivets.

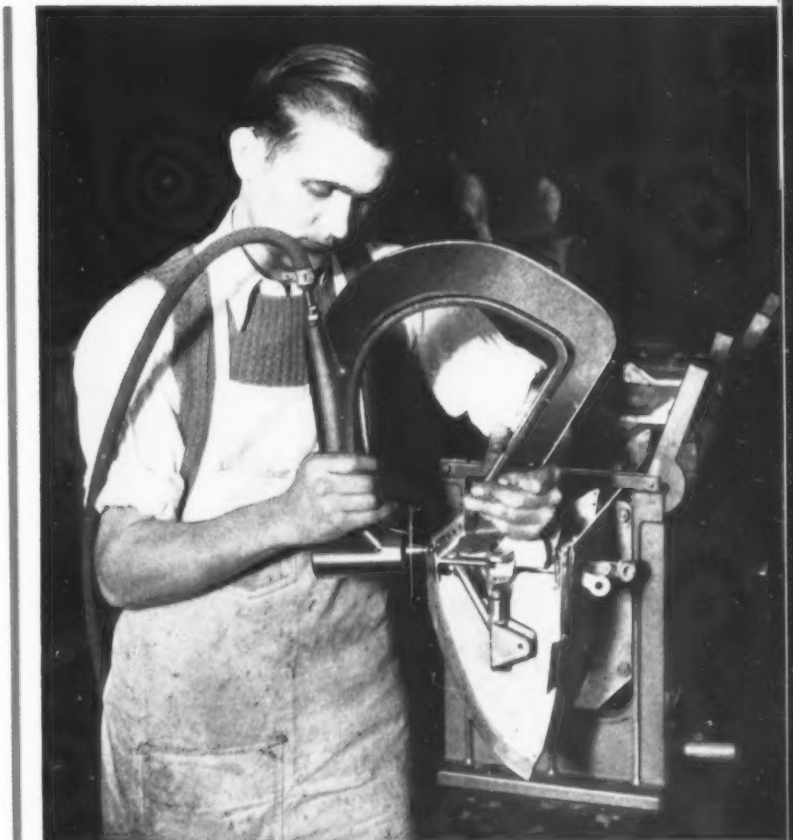
The riveting hammer here shown is typical of those used in the Curtiss plant. The anvil is held opposite the rivet peening tool by a U-shaped arm which is cast integral with the hammer housing. The shape of this arm varies in the different hammers to adapt them for the operations on which they are employed.

After the operator has inserted a rivet through the metal sheets to be assembled and has placed the riveting hammer in position, he presses a trigger to admit compressed air into the cylinder behind the hammer spindle. The first effect of the compressed air is to advance the hammer spindle

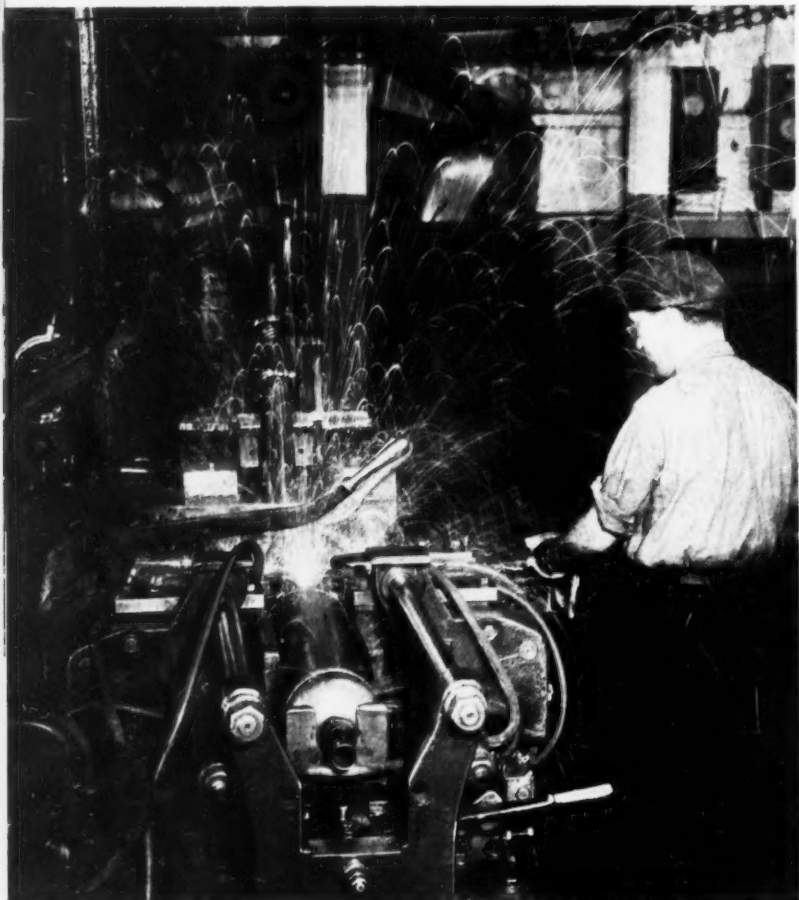
so as to reduce the gap between the peening tool and the anvil. At the approximate point where the anvil comes in contact with the rivet, the peening tool starts reciprocating to form the rivet head.

Hollow aluminum alloy rivets are used. They are heat-treated in the conventional manner to soften them and improve their workability. After the heat-treatment, the rivets are kept in an electric refrigerator until just before they are used, so as to delay ageing until after they have been driven.

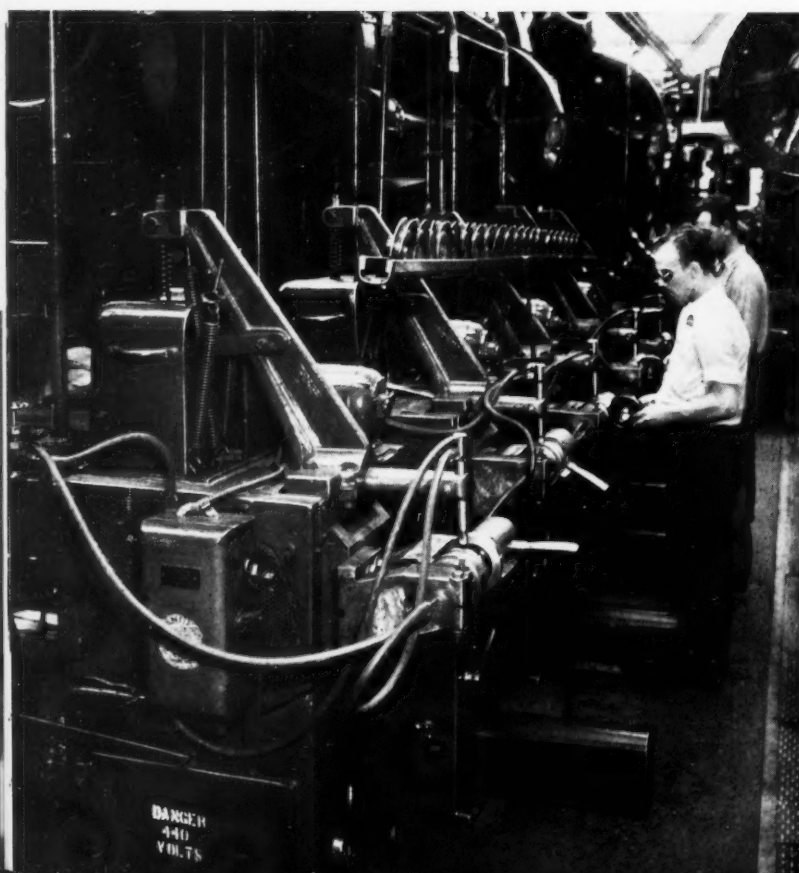
Pneumatic Riveting Hammer with an Integral Arm that Holds an Anvil Opposite the Peening Tool



Sparks Fly from 1600 Welders



Welding is One of the Reasons why the Fast Powerful Automobiles of Today can be Sold at Low Prices. Welds have Largely Replaced the Bolts, Nuts, Rivets, and Solder Used in Former Days for Assembly Purposes. Between 4000 and 5000 Welds are Made on the Ford V-Eight, and the Number Increases All the Time. This Illustration Shows a Flash- or Butt-welding Operation for Attaching the Intake Pipe to a Muffler. The End Covers are Also Welded to the Muffler Shell in Separate Operations



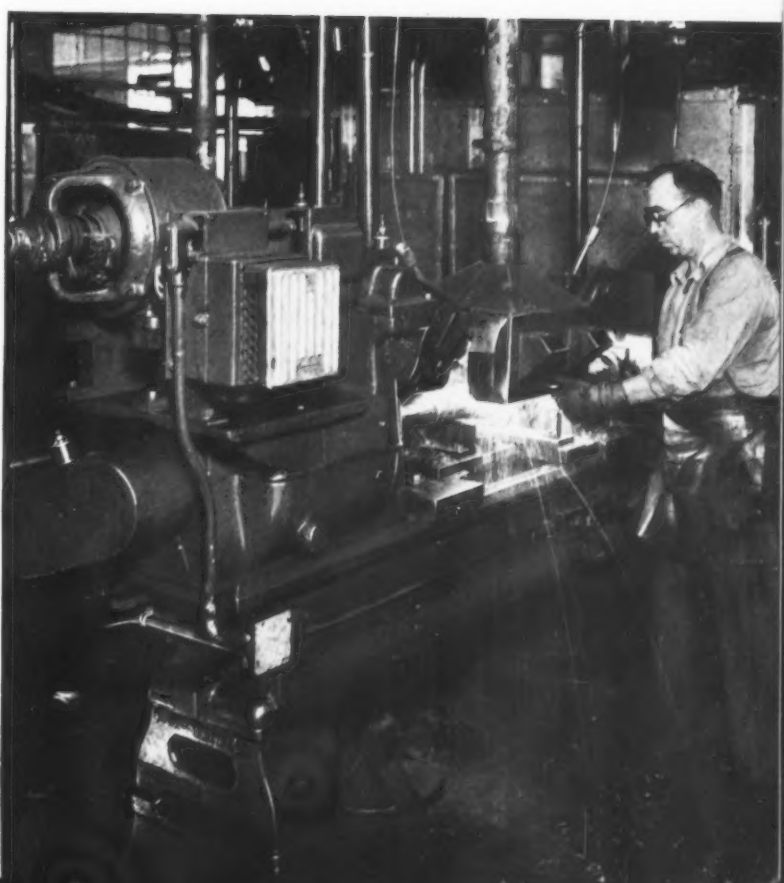
Five Different Types of Welding are Applied Extensively at the Rouge Plant—Spot, Metallic and Carbon Arc, Flash or Butt, Resistance Seam, and Oxy-acetylene. The Majority of the Welds are Spot Welds, but There are Over 200 Electric-arc and Oxy-acetylene Welds on a Ford, and About 50 Butt Welds. Most of the Welding Machines are Automatic and are Controlled by Electronic Tubes. On the Machines Shown Two Flanges are Welded Together to Make Sheet-steel Pulleys

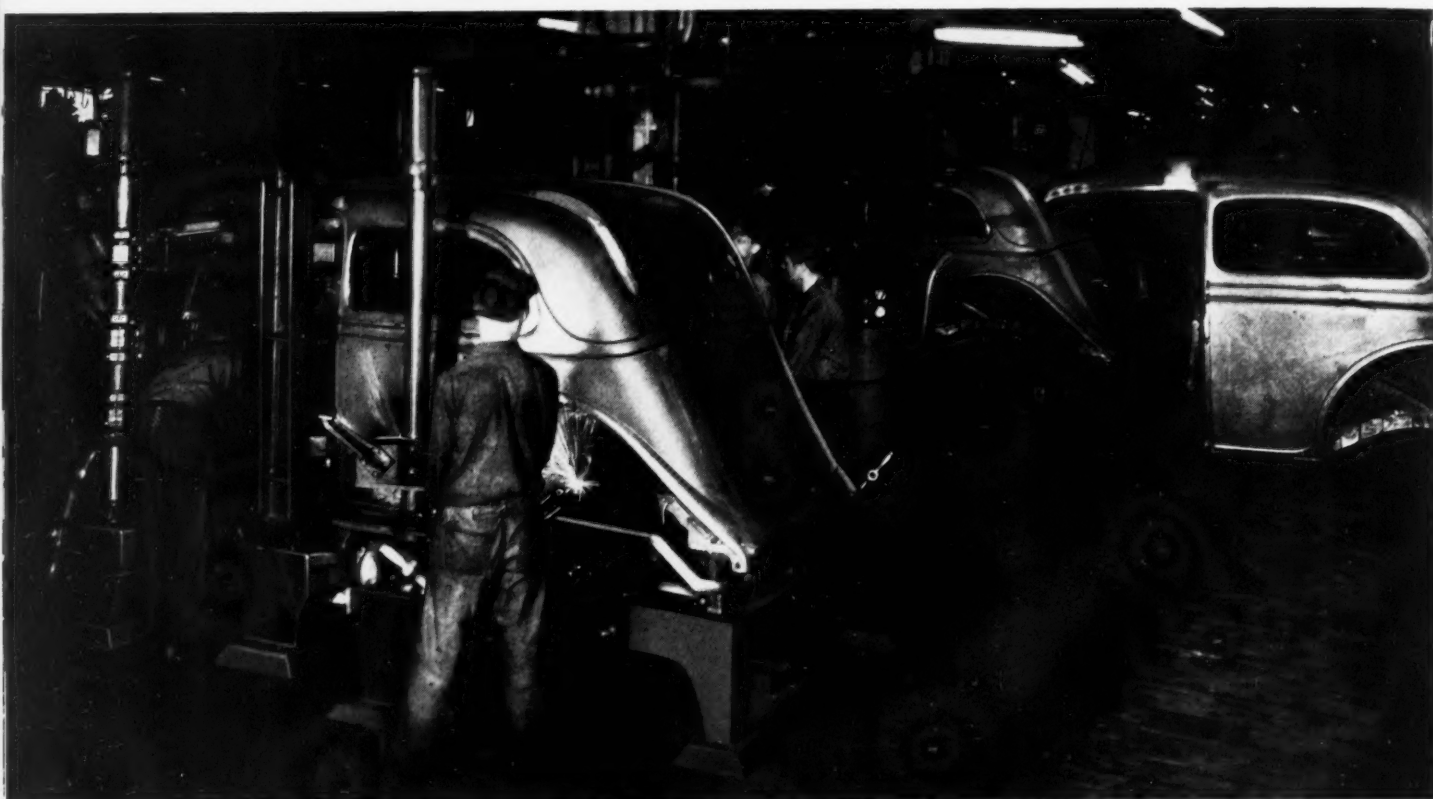
in Building Ford V-Eights

With the Wider Application of Welding in Automobile Construction, There has been a Large Reduction in the Number of Squeaks Likely to Develop when the Car is in Service. In the Operation Here Shown a Door Frame and its Outer Panel are Made into a Single Unit, Free from Relative Movement and Resultant Squeaking. Thirty-two Spot Welds are Made, Eight at a Time, by Simply Pressing a Button. Cam- and Air-operated Slides Bring the Work-pieces together and Clamp Them for the Welding



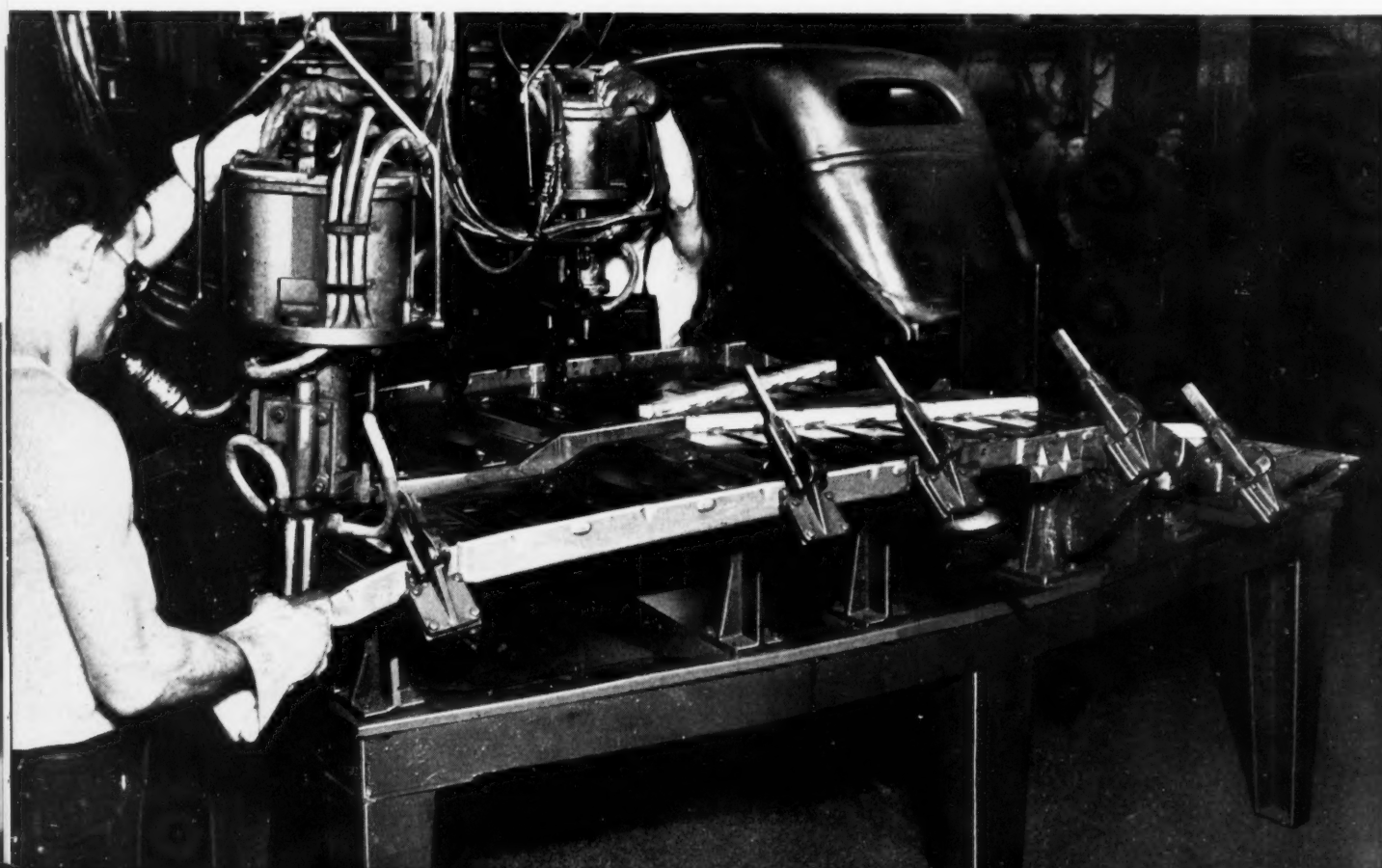
Some Parts Formerly Made Solid are Now Bent from Sheet Metal into Tubular Forms and Arc-welded into Strong Members. On Such an Operation Performed on Rear Axle Housings, High Output is Obtained by Employing General Electric Automatic Heads for Welding the Longitudinal Seams. In this Illustration, a Wheel Flange is Being Arc-welded to Two Pieces of Tubing to Form a Rear Axle Housing. The Work-pieces are Revolved beneath Two Welding Heads which Operate on Both Sides





Automobile Bodies are Assembled by Welding a Floor Pan, Front End and Rear End together while They are Held Securely in a Jig as Shown Above. In Operations of this Type, Many Spot Welds are Made with Guns which are Pivoted on Copper Bars that Extend along the Outside of the Jig

Welding Guns, Many of them Designed to Meet Special Conditions, are Used Extensively Throughout the Plant. The Illustration Below Shows an All-metal Floor Pan being Spot-welded in a Jig that Insures Interchangeable Floors. The Electrodes of the Guns Here Shown are Air-operated

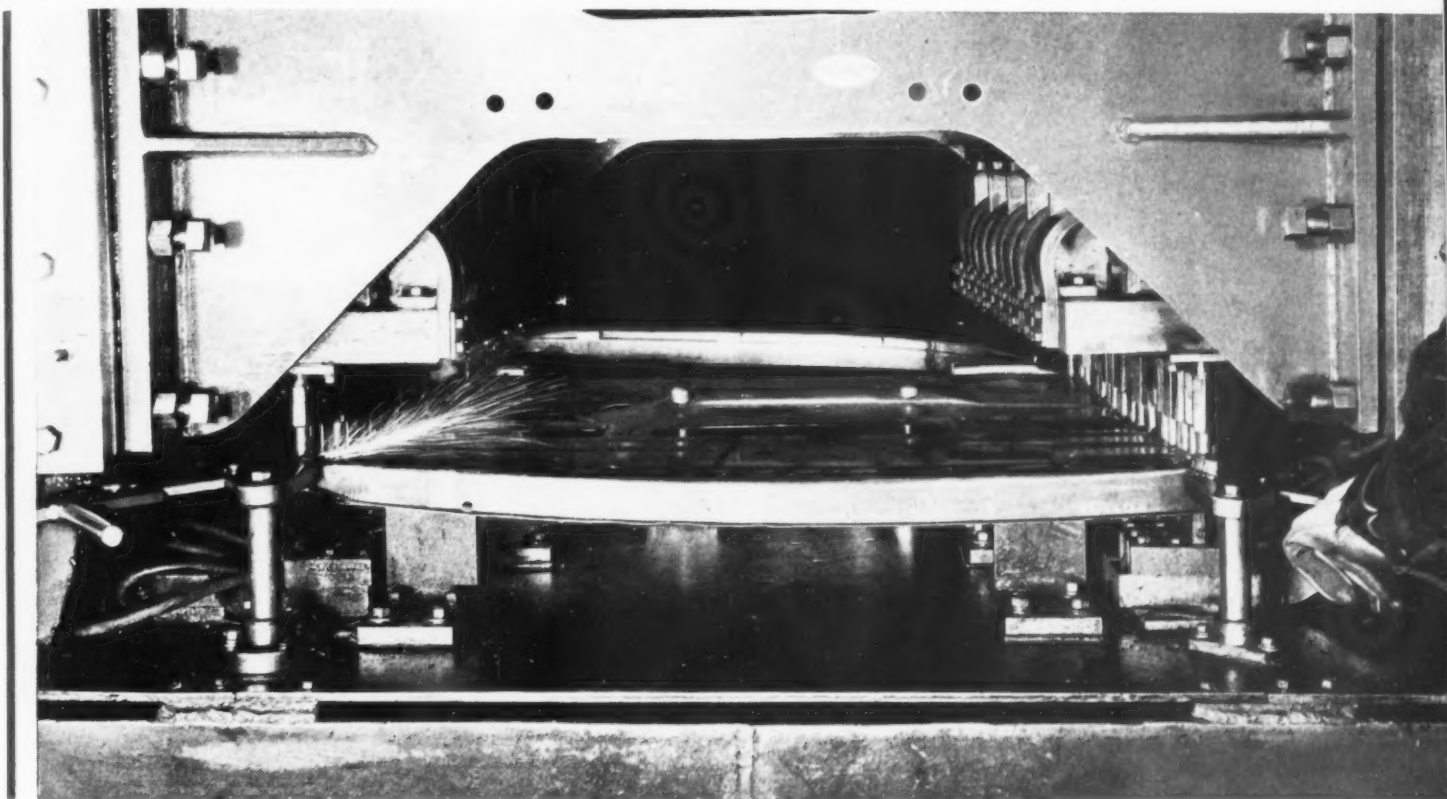


>

>

>

IN BUILDING FORD V-EIGHTS



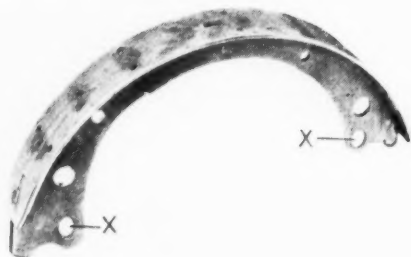
(Above) Forty Spot Welds are Made in One Operation on Inner-door Panels by the Equipment Shown. Twenty Pairs of Electrodes Simultaneously Weld One Side of the Panel, and a Similar Series Welds the Opposite Side. Four Panels are Welded Each Minute by the Machine Illustrated and a Single Operator

(Below) With a Spectacular Shower of Sparks, the Three Panels that Make up a Rear Body Assembly are Flash-welded together. Two Seams each 72 Inches Long are Completed in Seven Seconds. Four of These Huge Machines, Believed to be the Biggest Welders ever Built, are in Daily Use at the Rouge Plant

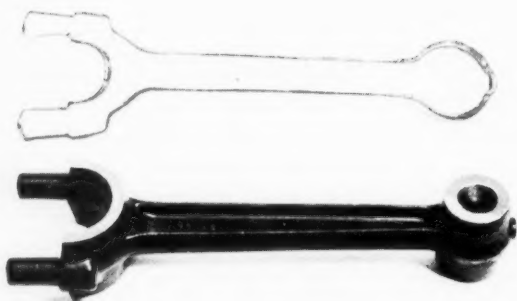




1



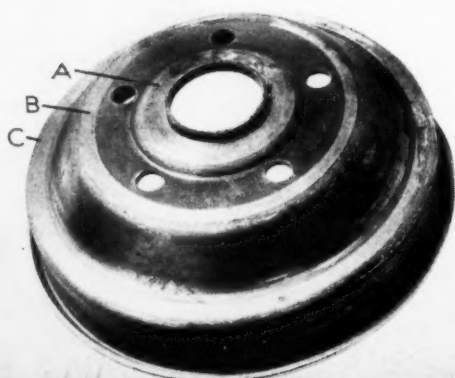
2



3



4



5

Broadening Use of

Industries More and More are Availing Themselves of the Advantages of Coining—It Provides an Economical Means of Obtaining Accuracy of

COINING is being increasingly adopted by industrial plants as a standard operation for finishing by pressure both flat and curved surfaces on steel and non-ferrous forgings and stampings, and even on steel and malleable-iron castings. The chief reason for the widening application of coining lies in the fact that duplicate parts can be finished at low cost to specified dimensions within a few thousandths of an inch. As no stock is removed from the surfaces in coining, the finished article retains the original tough outer skin of the forging or casting. This gives it added resistance to wear.

The automotive industry has been in a position to apply the coining process more widely than any other industry, primarily because of the large quantities of identical parts manufactured. However, that the advantages of coining are being recognized in other industries as well will be apparent from the examples of work here shown. These parts have all been coined in Maxipresses built by the National Machinery Co., Tiffin, Ohio.

In the coining process, as applied in industry, parts are squeezed to the desired thickness or shape on heavy vertical presses, the principle being similar to that employed in producing coins. The operation is entirely a finishing one. Coining is generally done on parts at room temperature, but parts can also be coined as they come from the forging machines or hammers, as heat facilitates coining. For better finish, the temperature should be below the scaling point.

One of the most important factors in successful coining, and one that has not always been thoroughly understood, is that the press must be of such a rigid construction that it will always close the dies to the same point, regardless of variations in the thickness of the work or in the material. It is common for forgings to vary from 0.010 to 0.030 inch in thickness as they come to the coining press. The pressure exerted in the coining operation

f the Coining Process

*Shape and Dimensions within
Thousandths of an Inch—
The Process is Applicable to
Forgings, Stampings, and Steel
and Malleable-Iron Castings*

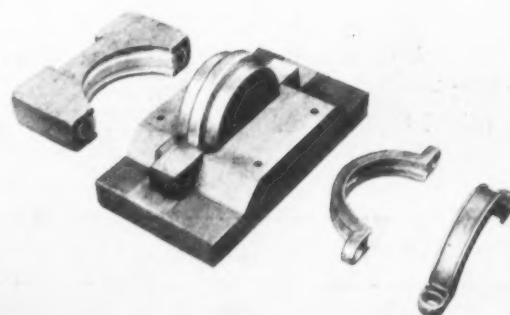
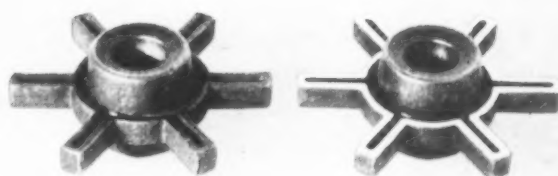
causes the work to become heated, and this helps the metal to flow. The press must be powerful enough to keep the metal flowing until the work has been brought to the desired shape or dimensions. If the press members stretch during the application of pressure, the coining operation will not be satisfactory. Constantly uniform pressure, as obtained only in the most rigid type of press, causes the metal to continue to flow easily once it is started. This also results in increased die life.

Accuracy in coining also depends upon the dies used. It is common practice to coin pieces to size within limits of plus or minus 0.002 inch. However, closer limits can be adhered to if sufficient attention is given to the construction and maintenance of the dies. On the other hand, if a grinding cut is required subsequently on a coined surface, as, for example, on the bosses of automobile connecting-rods, limits of plus or minus 0.005 inch are generally close enough.

The amount that parts can be reduced by coining depends upon the capacity of the press. Care should always be taken to insure that the press has sufficient strength for the operation, as otherwise some part of the press may be broken. Maxipresses are designed to stall when overloaded and thus avoid the breakage of members. Coining dies for cold coining are generally made from a cold-working steel, such as is used for heading bolts and rivets.

There are two general types of coining—first, the coining of flat surfaces to the desired thickness, and, second, the coining of surfaces to the required contour. Fig. 1 shows six gear blanks which represent coining of the first classification. These blanks are merely pressed between flat die surfaces which squeeze the rims and hubs to specified thicknesses.

The steering knuckle in the same illustration is an example of more complicated coining of the same general class. The two bosses of this part



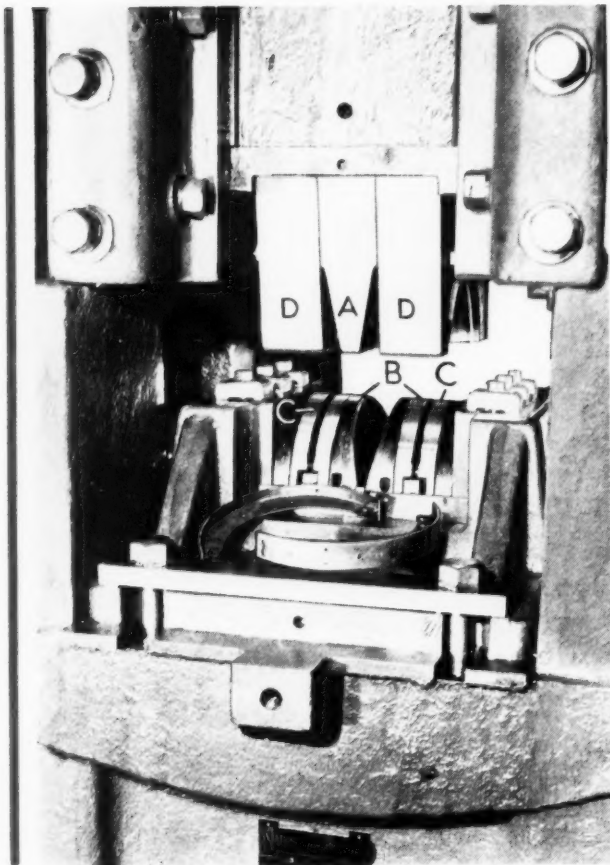


Fig. 11. Coining Die Used to Press Rim of Brake-shoe Shown in Fig. 2 to Correct Radius and to Punch Two Holes through Web

are coined on the ends to produce flat surfaces a specified distance apart, and, in addition, the ball end and the long shank are coined to a certain diameter. These various surfaces must not only be precise as to their individual dimensions, but they must also be in accurate relation to each other when they leave the coining press. All of these surfaces are later finished by grinding.

The brake-shoe illustrated in Fig. 2 is an example of the second type of coining. This part consists of a curved rim of sheet metal with a web of sheet metal welded to it. The coining operation consists of squeezing the rim so that it will have a radius of 6 inches within plus or minus 0.003 inch.

Fig. 11 shows the equipment developed for this operation. Two shoes are coined simultaneously. When the ram of the press descends, a wedge *A* enters between the sliding jaws *B*, moving them sidewise so as to grip the web of the shoes firmly against the stationary die members *C*. In this way,

the web is prevented from buckling as punch members *D* coin the rim of the shoes to the desired radius. In addition to insuring the correct radius, this operation flattens all spots produced on the rim by the welding.

Before coining was adopted for shaping the rim of these brake-shoes, it was the practice to chuck the shoes in a group and then turn them in a lathe. Coining has obviously greatly reduced the finishing time.

When the ram of the press is at the bottom of its stroke and the coining has been completed, a mechanism in the dies operates four punches horizontally to pierce holes *X*, Fig. 2. This, naturally, gives an accurate location of the holes in relation to the rim. When the shoes are removed from the machine, they are located in an inspection fixture by slipping these punched holes over plugs. An indicator gage is then applied along the rim of the shoes.

Connecting-rods of the style shown in Fig. 3 are coined all over, the flash later being trimmed off. The illustration shows the typical amount of flash obtained. This coining operation is so closely controlled that the connecting-rods do not vary in weight more than plus or minus 12 grams (0.388 ounce) from the specified weight. The coining of the connecting-rods so closely to weight has eliminated the need of matching the rods for an engine. The boss faces of these rods are also held to close limits for thickness and parallelism.

This coining operation is performed at low heat and can take place immediately after the trimming operation which follows drop-forging, the connecting-rods still retaining some heat. The coining dies used are identical in shape to the drop-forging dies. Coining is performed at the rate of 9000 rods in eight hours, an average of more than 18 rods a minute.

Flywheel ring-gear blanks of the type shown in Fig. 4 are customarily produced by cutting coiled stock to the required length and butt-welding the ends together. The ring gears here shown are coined on both the inside diameter and on the flat faces. Attached to the ram of the Maxipres is a punch which is tapered on its lower end and which is recessed to the outside diameter of the gear blank.

When the ram descends, this punch pushes the tapered arbor down into the gear blank, expanding it to the required inside diameter, and then compressing it to the specified thickness by pressing it against a shoulder on the arbor. A stripper removes the gear blank from the arbor. The gear

blanks are held to the specified thickness within plus or minus 0.016 inch, being expanded from 1/16 to 3/32 inch in outside diameter.

Brake-drums of the type shown in Fig. 5 are coined to remove any buckle produced in the drawing operations and to insure specified dimensions. The maximum inside diameter of this piece is 11 inches; it has an over-all length of 4 inches, and is made of sheet steel 1/8 inch thick. The coining dies exert pressure on the three flat planes A, B, and C, making them parallel and the required distance apart. No subsequent machining is performed on this drum.

In coining malleable-iron castings, care must be taken to avoid striking a sharp blow, as a crack is likely to be started that may develop in service. On the other hand, economy demands that a high-speed press be used. With reasonable care in the set-up of the dies and in the operation of the machine, the coining of malleable-iron castings can be performed satisfactorily.

A noteworthy example of coining malleable-iron castings is presented by the piece illustrated in Fig. 6. This part has a spherical surface A, the radius of which is very important, and the spherical surface must also be accurately located with respect to the angular surface B. When this casting cools after the malleableizing process, it becomes warped; this condition is rectified by coining in dies shaped to the desired contour.

Fig. 7 shows a malleable-iron casting for agricultural equipment which is coined on the two ends

to press them to the required thickness and bring them into the correct relation to each other. The thickness of the large end is reduced from about 1.810 to 1.763 inches in this operation. This part has an over-all length of about 6 1/2 inches.

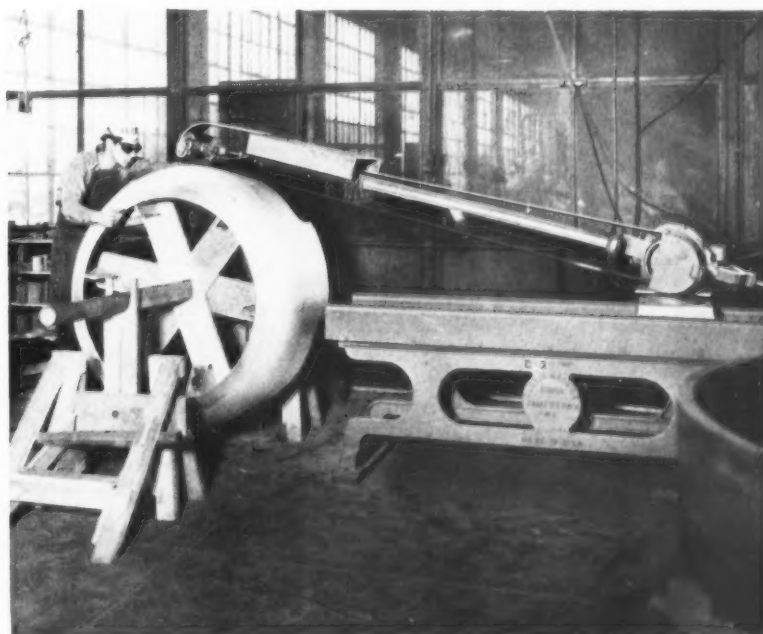
Clutch-hub spiders of the type shown in Fig. 8 are coined simultaneously on both sides of the six arms and of the circular flange that surrounds the hub. All of these surfaces must be parallel and of the specified thickness within close limits. Coining greatly reduces the cost of manufacturing this piece compared with the practice of milling the sides of the arms individually. Finish turning or grinding would hardly be practicable due to the intermittent cuts that would be required.

Pipe clamps of the style shown in Fig. 9 are used extensively on oil lines. These clamps are forged under a drop-hammer. In cooling, they tend to twist, with the result that the feet must be straightened to enable two clamps to be assembled together.

By coining with the die equipment shown in Fig. 10, the feet are brought into a straight line, and at the same time, the semicircular surfaces are set to the correct radii. It will be observed that the die members are made to fit the contour of the clamp along its ribbed section. The clamp illustrated has an inside diameter of 9 inches.

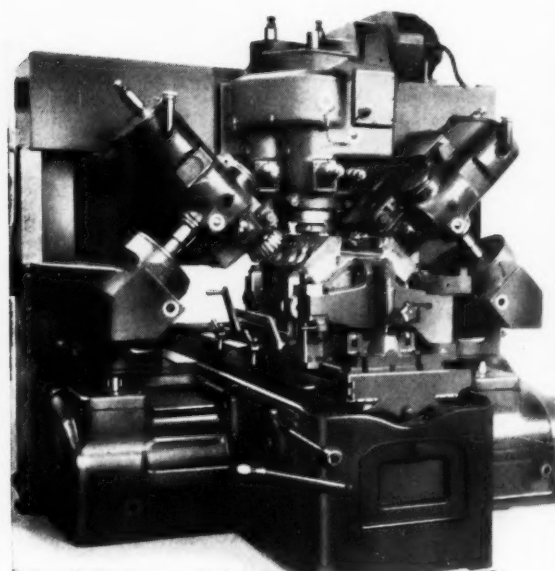
The foregoing examples emphasize the possibilities of lowering production costs by employing the coining process to eliminate or reduce machining operations.

Polishing Cowl Rings for Airplane Engines at the Curtiss Aeroplane & Motor Co.'s Plant on an Abrasive Belt-polishing Machine. Cowl, Mounted on Wooden Spider, is Revolved by Hand while Grinding Head is Pressed Against it



Adapting Present Equipment

*How Milling Machines Originally
Automobile Parts were Rebuilt and*



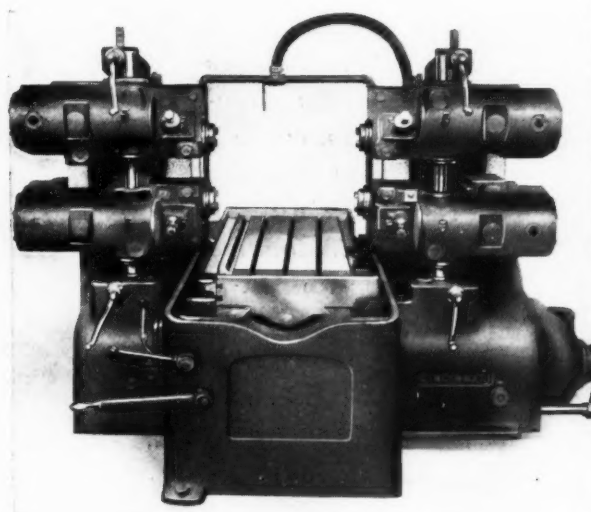
RECENTLY, an automobile manufacturer was confronted with the problem of installing a new cylinder-block line to produce a new engine and to meet definite production requirements. The purpose of this article is to show how milling machines first installed about five years ago were provided with additional equipment to fit them into the new cylinder-block production line. Some entirely new equipment was also installed for operations where the present equipment could not be used.

Close cooperation between the milling machine manufacturer and the automobile builder enabled the latter to obtain the equipment best suited to his requirements at a minimum investment. The machines involved were Cincinnati Hydromatic production milling machines. The unit construction methods used by the Cincinnati Milling Machine Co. permitted the rebuilding and rearranging of the present equipment for the new cylinder blocks with a minimum expenditure. A great many standard units mounted on the original machines could be salvaged and used again on the rearranged equipment.

Each of these units was inspected and brought up to date by adding improved details and new parts where necessary. Many of these standard units were mounted on the machine in a different

*Fig. 1. (Upper Left) Machine Used
for Milling Webs of Crankshafts.
Fig. 2. (Upper Right) Machine as
Rebuilt to Rough-mill Top Faces of
Cylinder Blocks*

*Fig. 3. (Below) Machine Originally
Used for Straddle-milling Brake-
hanger Lugs on Steering Knuckles*



to Changed Requirements

*Used for the Machining of Other
Rearranged for New Engine Block*

By W. D. AVERILL
Engineering Service Department
Cincinnati Milling Machine
& Cincinnati Grinders Inc.

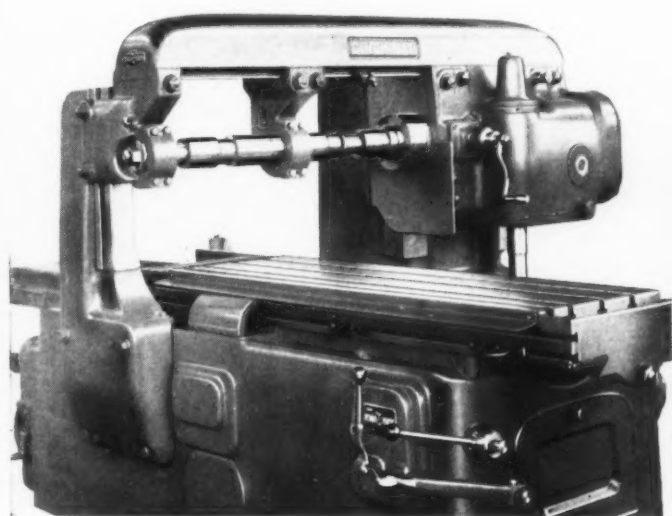


Fig. 4. (Upper Left) Machine Used for Milling Crankshafts. Fig. 5. (Upper Right) Machine as Rebuilt for Milling Bottom and Bearing Locks of Cylinder Blocks

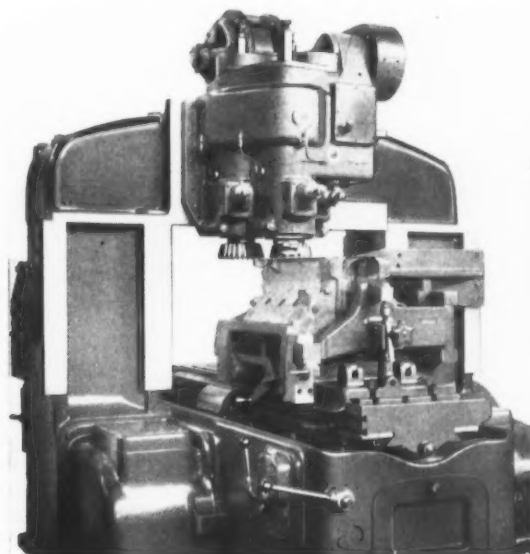
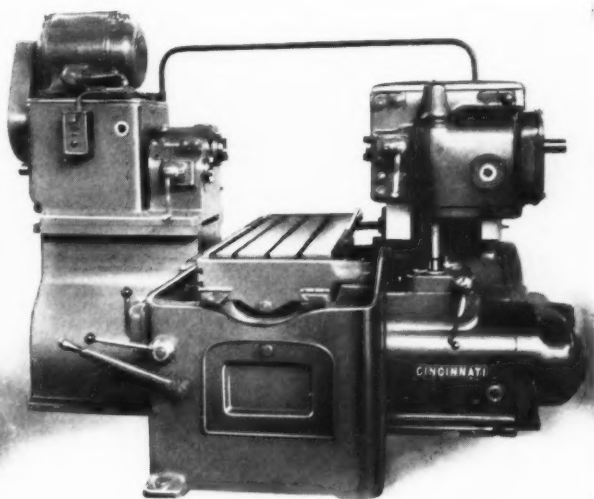


Fig. 6. (Below) Machine in Fig. 3 Rebuilt and Rearranged for Milling Both Ends of Cylinder Blocks



position from their original mounting, so that they could be used for the new requirement. The rearranged machines, when completely assembled, were carefully aligned, so that their accuracy and performance would equal those of new machines. A comparison of the original equipment with the rebuilt machines will best indicate the changes that were required.

The machine shown in Fig. 1 was originally used for milling the web of a crank on a large crankshaft. The rebuilt machine converted for use in the cylinder-block line is shown in Fig. 2.

Two machines of the type shown in Fig. 4 were originally employed for milling angle faces on large crankshafts, using special arbor supports. These two machines were converted as shown in Figs. 5 and 11. A standard 5-48 plain Hydromatic milling machine was rearranged as shown in Fig. 8. The machine shown in Fig. 3, originally used for straddle-milling the brake-hanger lugs of steering-gear knuckles, was rebuilt and converted as shown in Fig. 6. The machines shown in Figs. 7, 9, and 10 are new machines that complete the cylinder milling equipment.

The rough cylinder block first comes to the rebuilt machine, Fig. 2, for rough-milling the top surface, cover-plate surface, and two cylinder-head surfaces. By means of a conveyor type work-holding fixture, the work is pushed into position, located, clamped, and milled. A feed of 10 inches

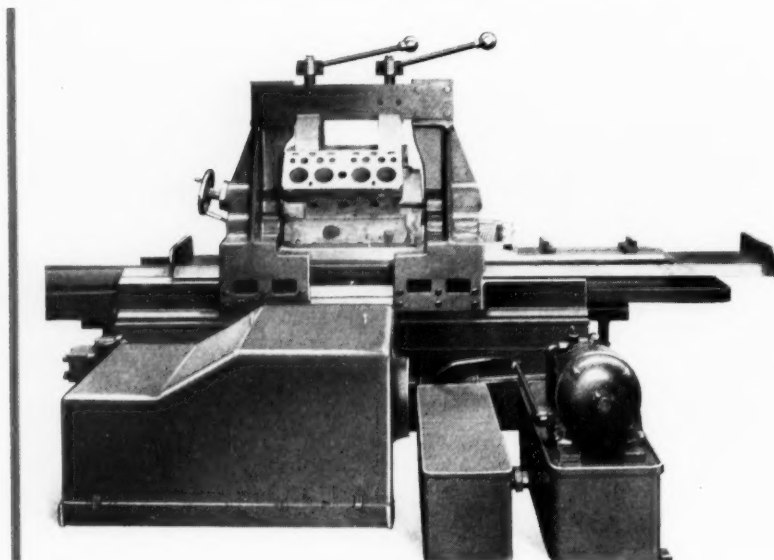


Fig. 7. Horizontal Broaching Machine for Finish-broaching the Bearing Locks

ceeding machining operations. The block is rolled into a fixture provided with gates at both ends, located, and clamped. With a large high-speed steel face mill and a feed rate of about 10 inches per minute, a net production of 12 blocks per hour is obtained. After the bottom face is milled, the machine table is stopped behind the cutter, and the work is removed before the table is returned to the starting position. In this manner, the cutter is prevented from traveling over the finished piece

and marring the surface.

The block now goes to the horizontal surface-broaching machine shown in Fig. 7, for finish-broaching the bearing locks. The work is pushed from the conveyor into a hand-operated fixture. High-speed steel broaches with taper gib adjustment remove a small amount of stock from the bearing locks, maintaining a tolerance of approximately 0.001 inch on width and alignment. This broaching machine, while special, is constructed from standard units of Cincinnati Hydro-Broach machines. A broach speed of 24 feet per minute gives a net production of 55 pieces an hour.

The next operation on the cylinder block consists of milling both ends of the block on the rearranged machine in Fig. 6. This machine is provided with a variable-feed attachment and cam, so that the feed can automatically be varied during the cut. An average feed rate of 8 inches per minute gives a net production of 14 pieces an hour. A simple conveyor type fixture holds the work.

The cylinder block is then conveyed to the three-spindle low-bed milling machine in Fig. 10, where various side pads are milled. This machine fits directly into the conveyor line. After the block is loaded in the conveyor fixture, two side pads are milled with the two horizontal spindles, one of which is provided with an eccentric adjustment to allow for cutter wear. A horizontal pad on the cylinder block is then milled at the required angle by means of a motor-driven vertical spindle provided with hydraulic cross-feed and rapid return. This makes

per minute with Stellite face mills gives a net production of 11 blocks an hour.

The cylinder block is then turned over and conveyed to the rebuilt and rearranged machine with three vertical spindles shown in Fig. 5. Here the bottom face and bearing locks are rough-milled. A conveyor type fixture on the machine table locates the work from the rough-milled angular cylinder-head faces. This machine is provided with a variable-feed attachment and variable-feed cam, so that the feed rate can be automatically slowed down when rough-milling the side surfaces of the bearing locks. As soon as the center cutter has passed these surfaces, the feed rate is increased automatically for milling the bottom flange surface. Stellite cutters with 12 inches feed per minute give a production of 12 blocks an hour.

The block is next conveyed to the rebuilt and rearranged machine in Fig. 8. On this machine, the bottom flange face is finished prior to the drilling and reaming of two dowel-pin holes for suc-

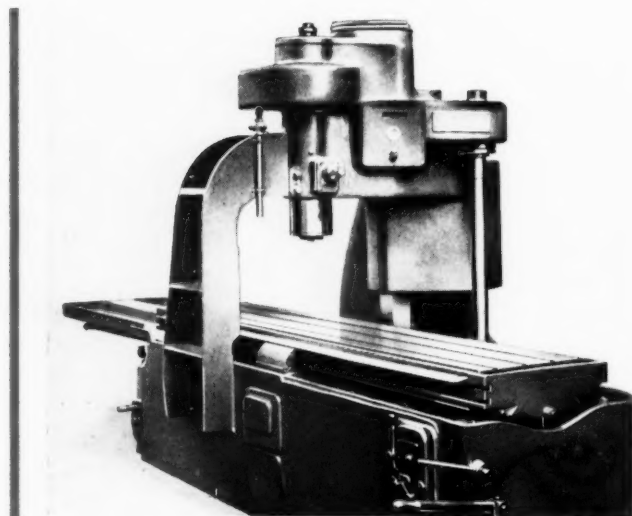


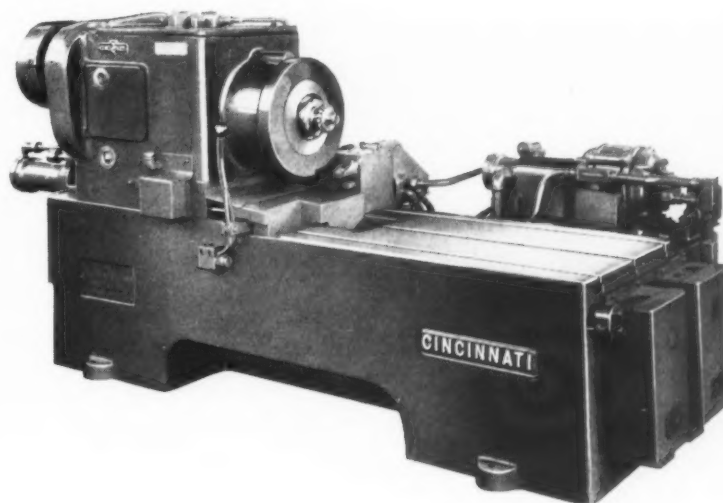
Fig. 8. Machine Used for Finish-milling the Bottom Flange of Cylinder Blocks

Fig. 9. Automatic Eccentric Milling Machine Used for Milling Oil-grooves

it possible to mill all of these pads at one setting. A feed rate of 7 inches per minute gives a net production of 37 blocks an hour.

The cylinder block is next conveyed to an automatic eccentric milling machine, Fig. 9, where an oil-slinger groove and an additional oil-groove are rough-milled. The work is held in a simple conveyor type fixture, and the operator simply starts the automatic cycle of the machine. The cutter-arbor enters the rear bearing, feeds crosswise, mills eccentrically for a complete revolution, and clears itself of the work by first moving back to the center of the bore and then away from the finished piece. Since the machine has a full-automatic cycle, the operator may leave the machine after starting. A net production of from 20 to 35 blocks an hour is obtained, according to the feed-gears used.

The last operation on the cylinder block is shown in Fig. 11. A rebuilt and rearranged machine equipped with high-speed steel cutters is used to finish-mill the top face, cover face, and cylinder-head face after all other machining operations are completed. The cylinder block is conveyed to a fix-



ture provided with double gates, so that the block can be finish-milled and then conveyed away from the machine from the rear before the table is returned to the starting position. This again prevents marring the finish on the return. The net production with an 11-inch feed per minute, removing about 1/32 inch stock, is 13 blocks an hour.

The equipment described takes care of all milling and broaching operations on the cylinder blocks. There are, of course, a number of intermediate drilling, boring, tapping, and honing operations. The average production is 11 cylinder blocks an hour.

Fig. 10. Three-spindle Low-bed Hydromatic Milling Machine for Milling Side Pads on Cylinder Blocks

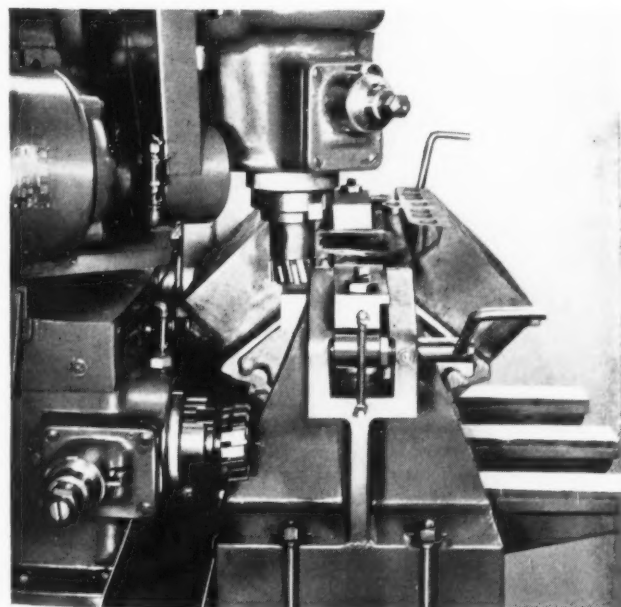
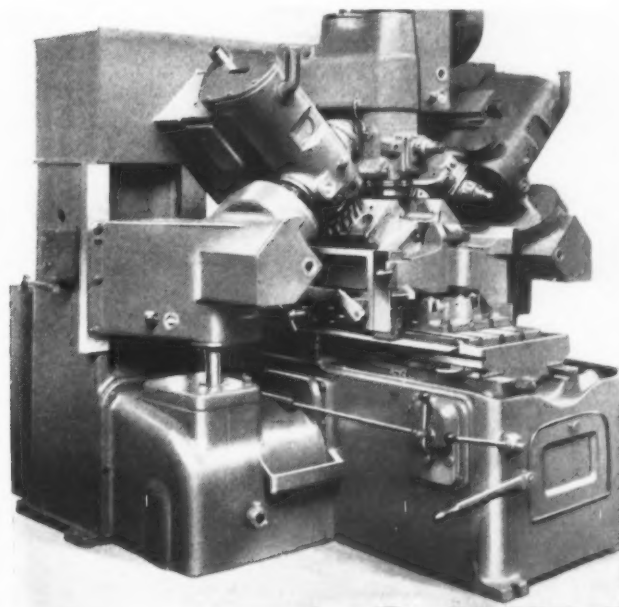
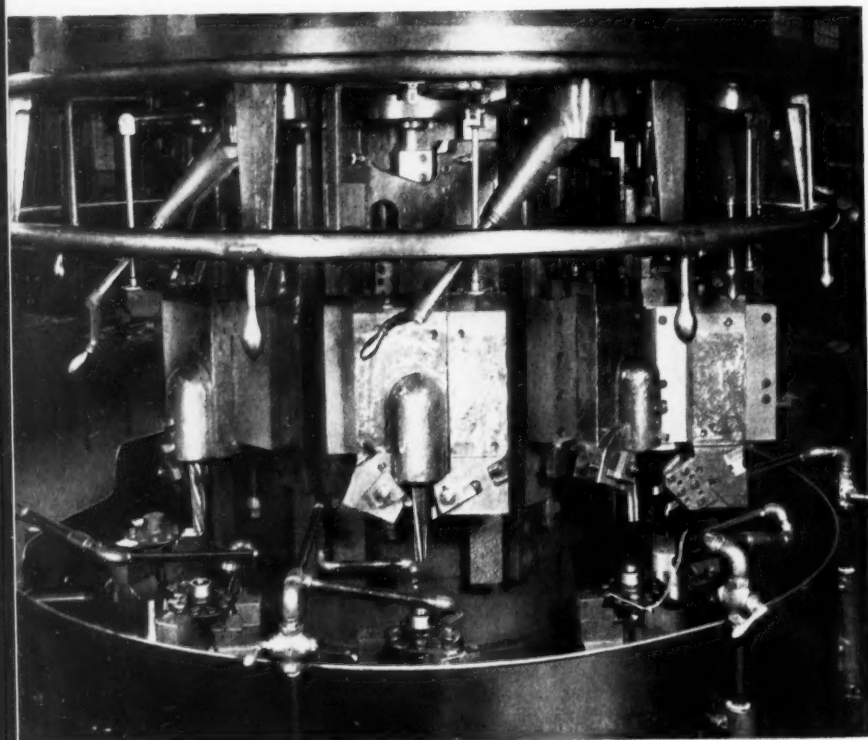


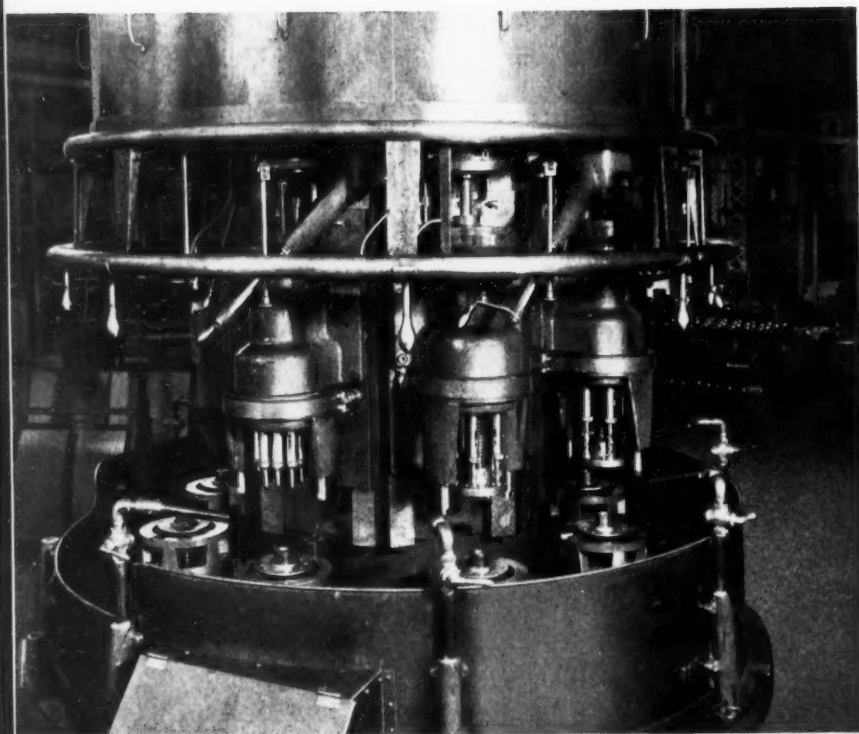
Fig. 11. Finish-milling the Top Faces of Cylinder Blocks on Re-built and Rearranged Machine



Speeding Automotive Production



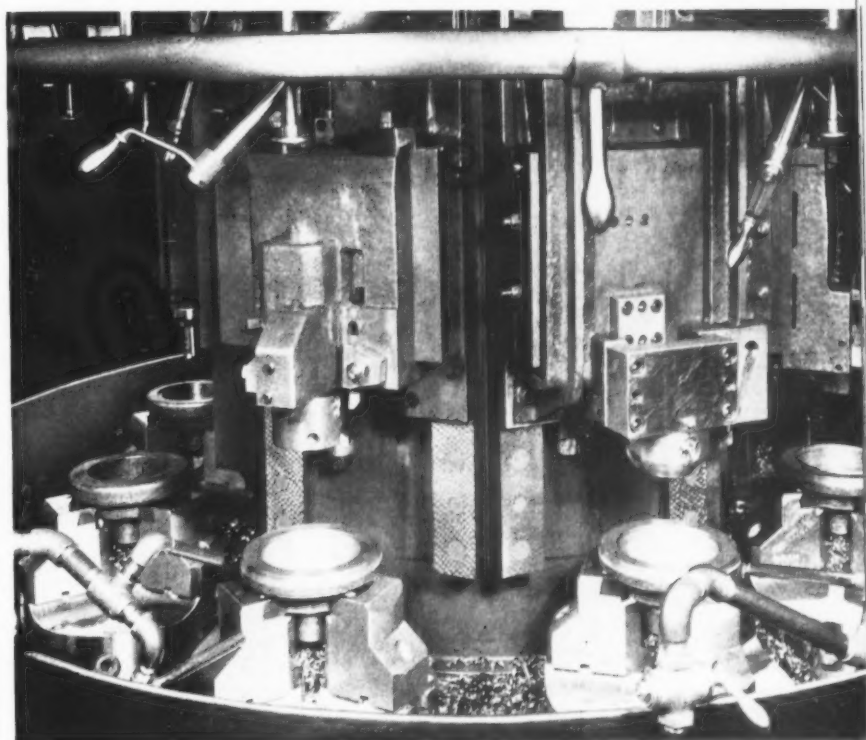
Machining Wheel Hub (Steel Forging) on an 8-inch, Eight-spindle, Bullard Mult-Automatic. Sequence of Operations, First Chucking; Load; Drill; Rough-turn and Face; Ream; Finish-turn and Finish-face; Sweep. Production Time per Piece, 23 Seconds. An Average of 15 Ounces of Metal is Removed per Piece. Seven Pieces are in Operation Simultaneously



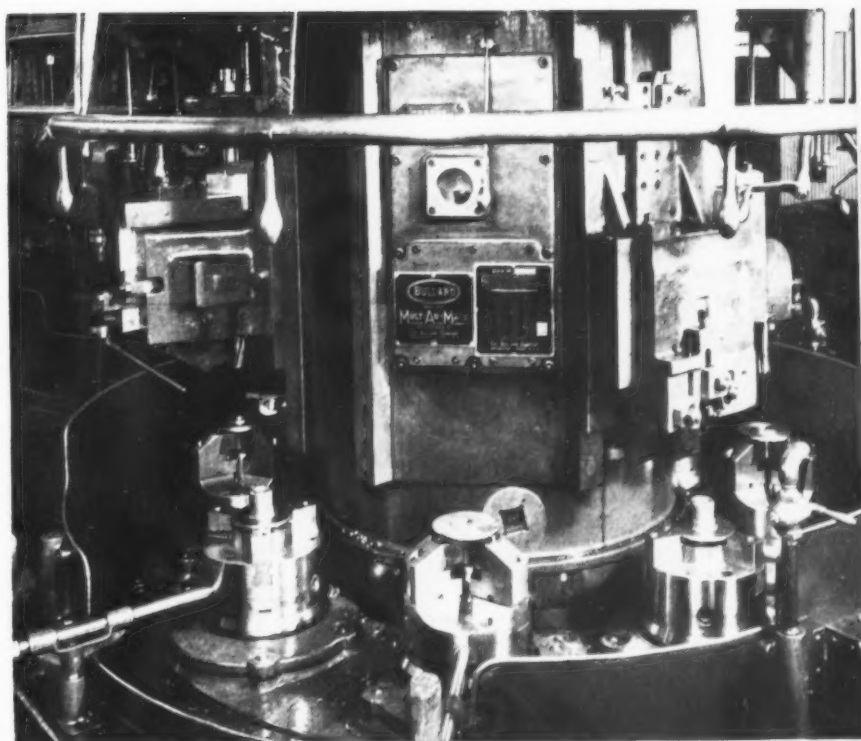
Machining the Wheel Hub Above, Second Chucking, on the Same Type of Machine as Used for the First Chucking. Sequence of Operations: Load; Rough-turn and Rough-face; Finish-face; Finish-turn and Chamfer; Drill and Countersink 10 Holes. Production Time per Piece, 20 Seconds. An Average of 13 Ounces of Metal is Removed per Piece

by Operations on Mult-Au-Matics

Machining Gear-case (Steel Forging) on an 8-inch, Eight-spindle, Bullard Mult-Au-Matic. Sequence of Operations, First Chucking; Load; Rough-bore; Sweep, Turn, and Rough-face; Rough-turn and Bore Radius; Finish-face; Finish-bore Radius; Finish-bore Hole and Turn. Time per Piece, 1 Minute 21 Seconds. Metal Removed per Piece, 3 Pounds



Machining Brake-drum Hub (Steel Forging). Using Double Index; Stations 1 and 2, Load, First Chucking; Drill, Rough-turn and Rough-face; Counterbore; True Bore, Finish-face, Chamfer and Size. Second Chucking; Rough- and Finish-face; Ream; Finish-turn, Chamfer and Form Radius. Production Time per Piece is 1 Minute 13 Seconds



Milling Cylinder Blocks by the

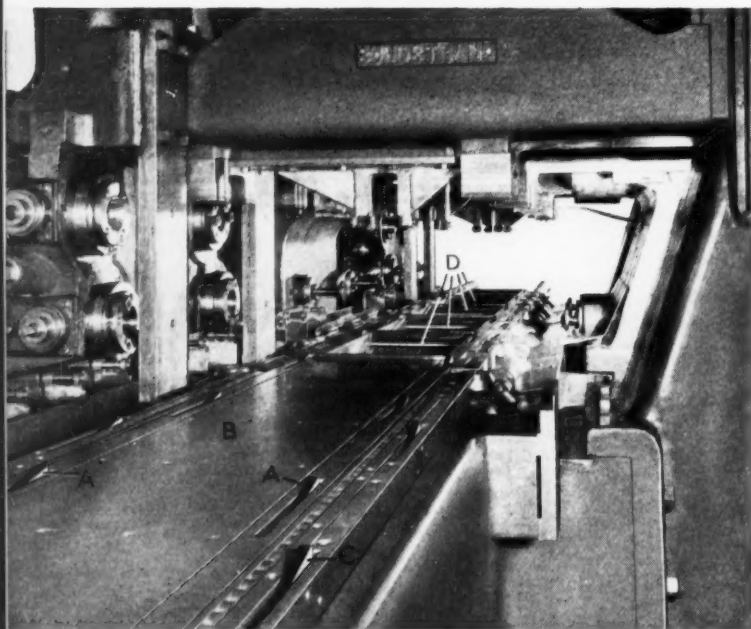
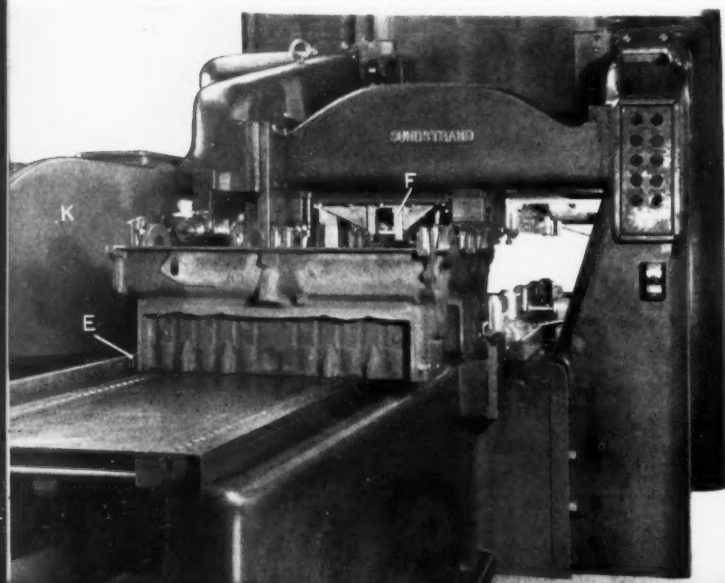


Fig. 1. Automatic Process Rigidmil which Automatically Locates, Clamps, Unclamps, and Indexes Cylinder Blocks for the Performance of Three Milling Operations



Fig. 2. The Cylinder Blocks are Advanced to the Various Stations of the Machine by the Latches of a Reciprocating Slide or Shuttle that Extends the Length of the Bed



Automobile Cylinder Blocks are Indexed, Shifted Sidewise, Raised, Clamped, Milled, and Lowered Three Times in a Machine Recently Built by the Sundstrand Machine Tool Co.

HYDRAULIC equipment and electrical control devices have been applied extensively to provide completely automatic operation of a Rigidmil recently built by the Sundstrand Machine Tool Co., Rockford, Ill., for performing three distinct operations on automobile cylinder blocks. The operations consist of rough-milling two end surfaces *X*, Fig. 7, at one station of the machine, straddle-milling two crankshaft bearings *Y* at a second station, and finish-milling the two end surfaces *X* at a third station. All three operations are performed on 115 cylinder blocks an hour. Six cylinder blocks are machined simultaneously, each operation being performed on two blocks at the same time. The term "automatic process milling" has been applied to the work performed in this machine, a complete view of which is shown in Fig. 6. The fact that this machine weighs 32 1/2 tons will give an idea of its size.

When the cylinder blocks come to the automatic process Rigidmil, they have already passed through a number of operations, including milling of the top and bottom, drilling, reaming, and tapping. The bearing caps have also been assembled. In the center of Fig. 7 is shown a cylinder block as it comes to the Rigidmil. At the right and left are blocks that have been finished by the machine.

The cylinder blocks reach the machine on a shop conveyor with the heads down. As the cylinder blocks move onto the bed of the machine, which is at the same height as the conveyor, they are engaged by latches *A*, Fig. 1, in a reciprocating slide or shuttle *B*. This shuttle extends lengthwise of the machine bed between two rows of hardened rollers that support the cylinder blocks. On the outside of the rollers are stationary hardened rails which contain a second set of latches *C*. When the shuttle moves toward the right, latches *A* advance the cylinder blocks. As the shuttle begins its re-

Rigidmil Automatic Process

Hydraulic Equipment Actuates Mechanisms for the Complete Handling of the Work and for Operating the Cutter-Slides. Electrical Devices Safeguard the Operations at All Points

turn movement, latches *C* in the stationary rails prevent the cylinder blocks from returning with the shuttle. They hold the blocks in the correct positions to be re-engaged by other latches *A* and advanced with the next movement of the shuttle.

When the cylinder blocks reach the milling stations, they are above a series of openings *D*. The chips from the operations fall into these openings and are moved forward through a trough in the machine bed when new cylinder blocks are advanced by the shuttle. Each time that the shuttle returns to its withdrawn position, gates in openings *D* swing over the accumulated chips and then fall back against a stop, which holds them vertically so as to sweep the chips ahead of them with the next forward movement of the shuttle. All chips that fall through the shuttle are thus carried to the right-hand end of the machine for convenient disposal. A similar arrangement is provided along the lower inside edge of each milling head.

There are always ten cylinder blocks in the machine, six in the milling stations and four on the left-hand end of the shuttle, as seen in Fig. 6. During the first part of their movement along the machine bed, one end of the cylinder blocks is in contact with a rail on the far side of the machine bed, as indicated at *E* in Fig. 2. This rail aligns the castings with an opening in an overhead slide *F* that straddles the center bearing cap. When the second cylinder block of each pair reaches this overhead slide, the slide moves both blocks sidewise toward the left until they reach the first milling station. At this point the two cylinder blocks rest on four hydraulically operated plungers or elevators *P*, Fig. 3, which rise until both blocks are clamped against hardened locating surfaces *H*.

Hydraulic power is applied to elevators *P*, of which there are twelve in the machine, through cams that mechanically lock the cylinder blocks in

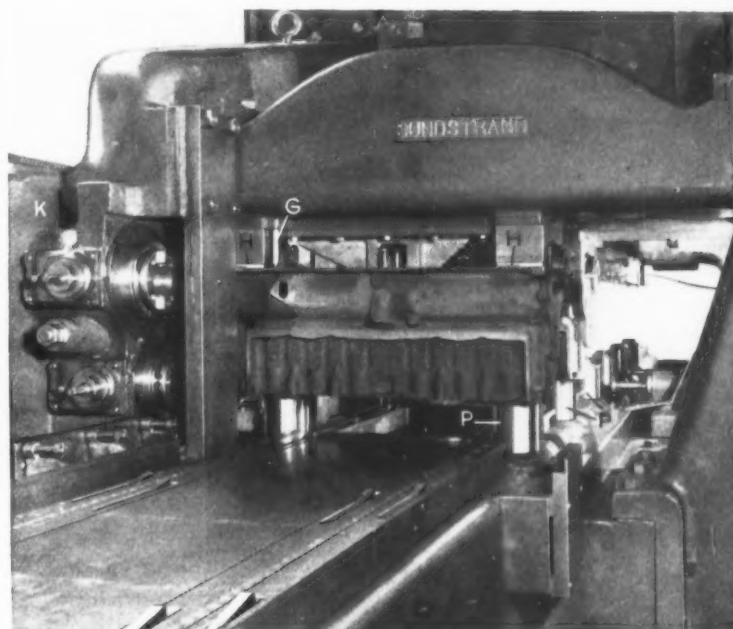
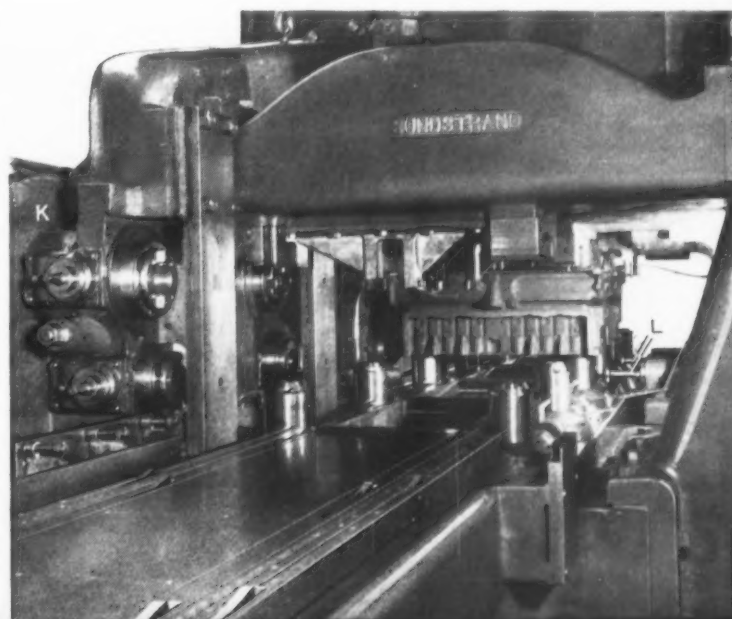


Fig. 3. Plungers of Large Diameter Raise the Cylinder Blocks into Position for the Three Milling Operations, where They are Automatically Clamped



Fig. 4. At the Second Station, an Overhead Slide Descends for Straddle-milling the Crankshaft Bearings, the Work again being Raised Vertically by Hydraulic Plungers



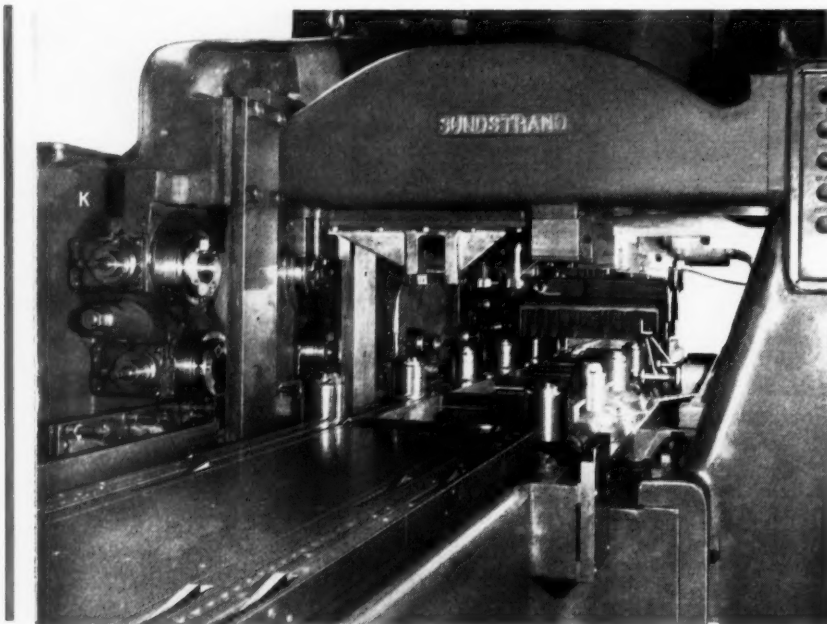


Fig. 5. At the Third Station, where the End Surfaces of the Cylinder Blocks are Finish-milled, the Machine Movements are a Duplicate of Those that Occur at the First Station, where the Same Surfaces are Rough-milled

the raised positions. This prevents the cylinder blocks from falling in the event that the hydraulic pressure is released before the milling operations are completed. When each cylinder block is clamped, it raises a sensitively poised rod *G*. This causes a corresponding lamp bulb *J*, Fig. 6, to become lighted. Failure of a rod to rise completely will stop the entire machine and prevent its corresponding signal bulb from lighting, thus indicating where the operator's attention is required.

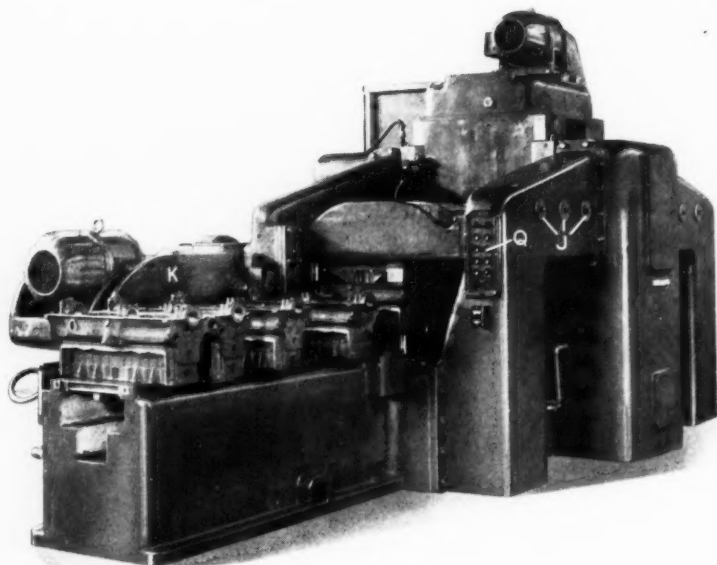
At the first station the two end surfaces of both cylinder blocks are rough-milled by four cutters carried on the heavy traveling head *K*. These cut-

ters do not appear in the illustrations, having been removed to show the spindle construction and the micrometer adjustment for each spindle quill.

After delivering two cylinder blocks to the first milling station, the shuttle returns to its starting position. During this movement, the shuttle latches are depressed into pockets as they pass under the next two cylinder blocks. The latches are raised immediately after they have cleared the second pair of cylinder blocks by springs.

As soon as the first milling operation is completed, elevators *P* are lowered and the overhead slide returns the two cylinder blocks that have

Fig. 6. General View of the Automatic Process Rigidmil which Performs a Series of Automatic Movements for Indexing, Clamping, Machining, and Unclamping Automobile Cylinder Blocks. An Average Production of 115 Cylinder Blocks per Hour is Maintained



been milled at this station into line with the shuttle latches. The shuttle then moves forward again to bring the cylinder blocks to the second milling station, directly over four more elevating plungers. At the same time, the traveling head *K* rapidly returns to its starting position.

Two hydraulically operated plungers *L*, Fig. 4, now move the cylinder blocks transversely toward the left. The elevators then raise the blocks, and they are clamped in the same way as at the first station. The center and end crankshaft bearings are now finished to length by straddle-mills mounted on a heavy vertical slide which automatically descends to the machining position at a rapid

cycle of rapid approach, feed, and quick return of the three milling heads are all actuated by hydraulic equipment built by the Sundstrand Machine Tool Co. The several hydraulic units are driven by direct-connected motors and are all accessibly mounted along the side of the machine bed that is opposite to the side seen in Fig. 6. Features of the hydraulic circuits include the continuous automatic elimination of air, maintenance of suitable operating temperatures, and low power consumption. The operator can release the pressure in the pipe lines instantly at any time, if desired. Automatic forced-feed lubrication to all gears and bearings of the machine is provided by Rota-Roll pumps.

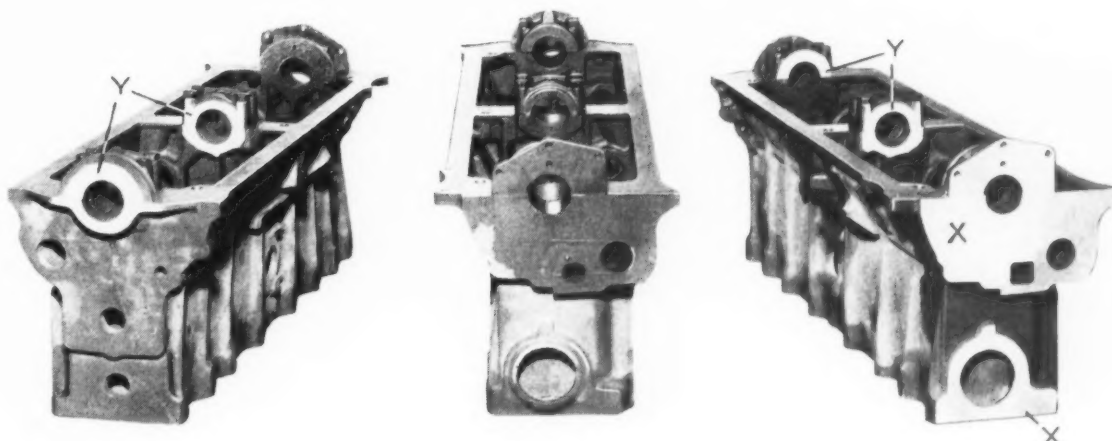


Fig. 7. To the Right and Left are Shown Cylinder Blocks that have been Milled, while Center View Shows Block as it Arrives at the Machine

rate, changes to a feeding rate, and quickly returns on the completion of the operation.

The blocks are then unclamped, lowered to the shuttle, shifted to the right by two hydraulically operated plungers on the far side of the machine, and again indexed to the third station, as indicated in Fig. 5. Here the first operation is duplicated to finish-mill the end surfaces of the cylinder blocks. Upon the completion of this operation, the blocks are released, lowered, shifted sidewise, and moved forward to the shop conveyor. The traveling head which performs the finish-milling operations does not return to its starting position until the cylinder blocks are out of the way.

The reciprocation of the shuttle, the moving and clamping of the cylinder blocks, and the automatic

The wires for the various electric circuits are of different colors and they run through rigid conduits provided with dust-tight covers and fittings. The central control panel *Q*, Fig. 6, enables the operator to start or stop all motors, operate the machine progressively, cause it to run continuously, or instantly stop the entire machine.

While this machine was designed for performing a group of operations on one type of cylinder block, it could easily be applied to other machining operations on different cylinder blocks by making suitable changes in the work movements and the tooling. The same principles of design and many of the same units could be incorporated in machines of substantially different design for performing operations on a wide variety of work.

Precision Thread Grinding

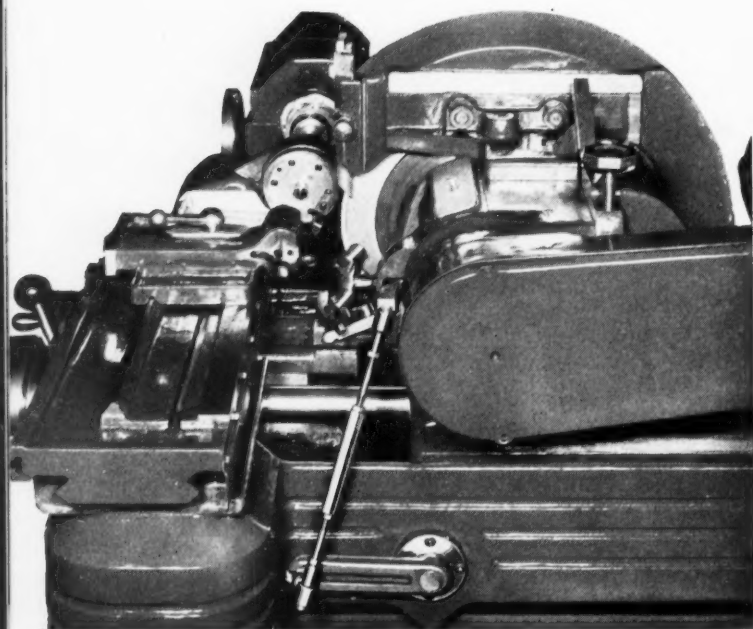


Fig. 1. Precision Thread Grinding Machine as Seen from the Right-hand End where the Mechanism is Located that Controls the Amount of Relief Ground on Taps



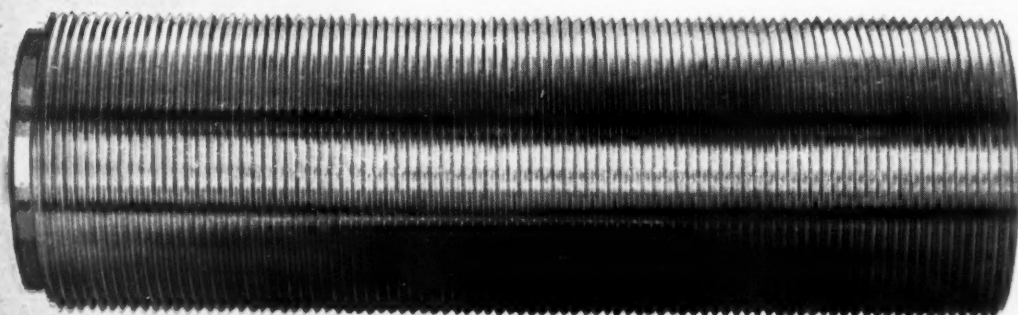
Fig. 2. Precision Thread Grinding Provides a Means of Accurately Correcting Distortion Errors due to Heat-treatment. Threads can also be Produced Entirely by Grinding Hardened Solid Blanks

Thread Inaccuracies Due to Distortion in Heat-Treatment Can Be Readily Corrected by Grinding. The Threads of Gages, Taps, and Other Precision Work Can Be Produced Entirely by Grinding Hardened Solid Blanks

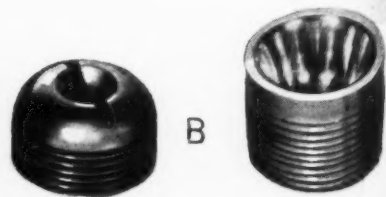
PRECISION thread grinding has opened the way to closer and stronger thread fits. In the past, fairly loose thread fits were often necessary, because the threads had to be finished before heat-treatment. The distortion that ordinarily occurs in heat-treating had to be allowed for, so that the parts could be readily assembled.

Precision thread grinding has made it possible to correct threads to within extremely close limits after heat-treatment. Thus, not only can threaded parts be heat-treated and then ground to obtain the desired fit, but threads of ten per inch or finer can be produced entirely by grinding the threads on plain blanks that have previously been heat-treated. This article shows examples of thread grinding performed on a machine recently made commercially available by the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich. This machine is intended for the wet grinding of either right- or left-hand threads of all common forms and leads.

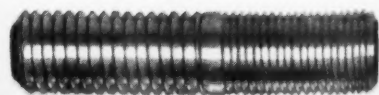
The practicability of grinding threads on hardened solid blanks is especially advantageous in the manufacture of taps, thread gages, double-end studs, and many other similar parts. It has been found economical to grind threads up to ten per inch on blanks up to 1 inch in diameter when the required quantity does not exceed 200 pieces. In



A



B



C

As a Manufacturing Process

By **IRA J. SNADER**
*Research Engineer, Machinery Division
Ex-Cell-O Aircraft & Tool Corporation
Detroit, Michigan*

larger quantities, it might be cheaper to rough-cut threads of ten per inch or coarser before hardening and then merely finish by grinding. In small lots, threads can be economically ground on hardened blanks as large as 5 inches in diameter.

In grinding threads from the solid, it is the usual practice to take a rough-grinding cut in both directions and then a finish-grinding cut in one direction only. About 30 pieces are first rough-ground; then the grinding wheel is dressed and these pieces are finish-ground, after which the wheel is used again, without redressing, to rough-grind another group of 30 pieces. In this way, 30 pieces are roughed and finished with each dressing of the wheel. Threads are ordinarily ground to a lead accuracy within 0.0002 inch per inch of length, or within a cumulative error of 0.0006 inch in 8 inches of length. On work up to 1 inch in diameter, the pitch diameter tolerance can be held to 0.0002 inch, and on larger pieces, it can be held to an additional tolerance of 0.0002 inch per inch of diameter.

The production in grinding threads on hardened solid blanks depends upon the diameter of the piece and the pitch of the thread. In grinding 5/16-inch taps with eighteen threads per inch, an average production of 120 pieces per eight hours (rough-

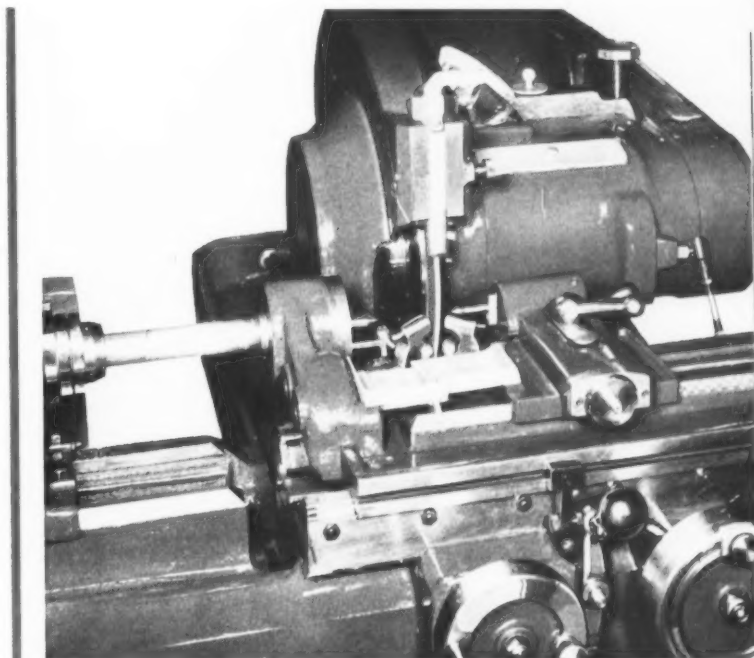
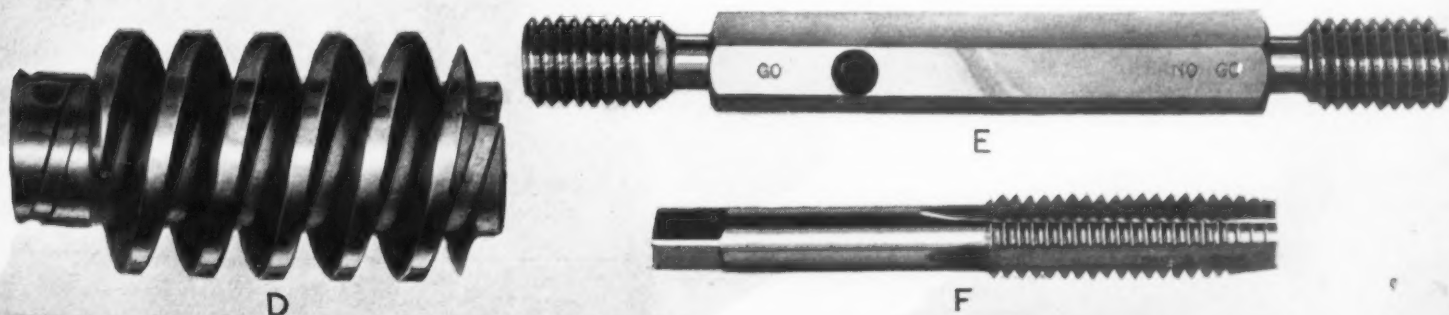


Fig. 3. View of Thread Grinder from the Front, Showing the Arrangement of the Diamond Wheel Dressers and the Hand-wheel for Adjusting Them, as well as the Cross-feed Handwheel



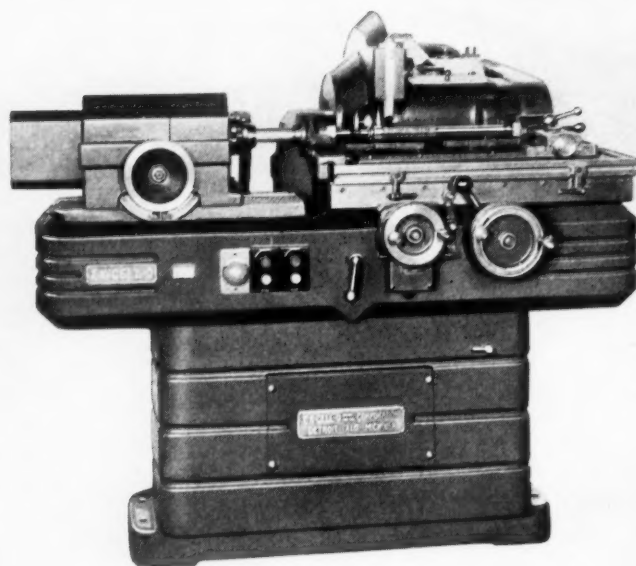


Fig. 4. The Precision Thread Grinding Machine being Used for Producing Threads on a Feed-screw—the Threads are Completely Formed by Grinding after the Part is Hardened

and finish-ground) is being maintained. The same production has been obtained with 1/2-inch taps having thirteen threads per inch. With 3/4-inch taps having ten threads per inch, a production of 68 pieces per eight hours has been maintained. Provision is made on the machine for grinding relief on taps when it is required.

Threads of any desired lead can be ground with ease in the machine here shown, as the lead depends upon a master lead-screw and nut which control the feed of the work carriage per revolution of the work. A different lead-screw and nut must be used each time that the pitch or lead of the work is changed. It takes less than fifteen minutes to change the lead-screw and nut; hence the machine provides an economical means of grinding threaded pieces in limited amounts, as well as in large quantities.

Studs of the type shown at *C* in Fig. 2 are used to a large extent in the construction of airplane engines. These studs are highly stressed in service, and it is desirable that their thread fits be as close as possible. To obtain an unusually tight fit, the threads of such studs are ground with the tailstock of the machine positioned to give a taper of 0.015 inch per inch of length. In grinding these studs, the practice is to grind one end of a lot to the desired thread diameter and pitch and then grind the thread on the other end of the same lot after substituting the proper lead-screw and nut.

Examples *B* in Fig. 2 are tappet adjusting screws for aircraft engines. The piece at the right has an internal spherical seat which must be al-

most glass hard. The threads on both pieces are ground after hardening, not only to insure accuracy, but also because, if they are machined prior to heat-treatment, cracks may develop at the root of the threads. These screws are 0.875 inch in diameter and are made with threads of the American Standard fine-thread series.

The master lead-screws used in the precision thread grinding machine are 7 inches long, 2 1/8 inches in diameter, and have a hole approximately 1 inch in diameter extending the full length through the center. One of these lead-screws is shown at *A* in Fig. 2. In grinding the threads on these master lead-screws, the lead-screw is supported on an arbor in the precision grinding machine. The threads are ground within a cumulative error of not more than 0.0002 inch in the full length of 7 inches. The bronze nuts engaged by the master lead-screws are threaded with taps that have also been accurately ground on this machine.

Acme threads and small worms such as shown at *D* in Fig. 2 are ground on the sides only in the precision grinding machine. The top of the threads may be ground in machines of the cylindrical type, but it is not necessary to grind the root. Worm threads with a helix angle up to 15 degrees can be regularly ground. The worm shown at *D* has a double thread of 1/4 inch pitch, 1/2 inch lead, and 1 1/2 inches outside diameter. This worm is used on a washing machine.

In changing from grinding V-threads to Acme threads, it is necessary to change the grinding wheel. This takes about fifteen minutes. Other

typical parts for which the precision grinding machine is particularly adapted include threaded automobile transmission shafts and parts for the supercharger drive of airplane engines.

The master lead-screw of the thread grinding machine is attached to the left-hand end of the work-spindle, while the nut is mounted stationary in the work-drive head. Threads up to 8 inches long can be ground with one setting of the machine. Then by making a longitudinal adjustment of the work-drive head so as to change the position of the master lead-screw and nut relative to the work, an additional 4 inches of thread length can be ground without removing the work from between the centers of the machine. Next by turning the work end for end in the machine, an additional thread length of 6 inches can be ground, making a total thread length of 18 inches, which is the maximum length of work that can be held between centers. A work positioning device operated by a handwheel is shown at the front of the headstock in Fig. 4. In changing from one work setting to another, it is an easy matter to "pick up" the thread that has already been ground.

Indexing means can be provided to facilitate the grinding of multiple threads. Threads up to 5 inches in diameter can be finished in this machine.

Wheel adjustments for various helix angles are made by swiveling a bracket on which the wheel-spindle is mounted. The wheel can be tilted a maximum of 15 degrees to the right or left. Graduations to 1/2 degree facilitate settings. The wheel-spindle is mounted in an eccentric sleeve which is oscillated when relief is required on taps. Oscillation is effected through the adjustable rod seen at the right-hand end of the machine in Fig. 1. The amount of oscillation imparted to the eccentric sleeve, and therefore the amount of relief ground on the work, depends upon the position of the lower end of this rod on the lever to which it is attached. On the opposite end of the shaft that carries this lever there is a second lever which is actuated by cams on the work-drive spindle. These cams operate the relieving mechanism in accordance with the number of flutes on the work.

Adjustment of the grinding wheel to suit the depth of cut is accomplished by means of the right-hand wheel on the front of the machine. Each graduation on this handwheel represents a movement of the grinding wheel of 0.0005 inch toward the work, or 0.001 inch on the diameter of the work. An adjustable pointer provides for quickly indicating the desired setting in relation to a fixed marker. Directly in back of the handwheel is a

lever which is moved to operate a rapid retracting device through which the grinding wheel can be instantly moved back from the work and accurately returned to the grinding position in operations where the thread is ground in one direction only. The grinding wheel is 18 inches in diameter and is mounted on a spindle that runs in Ex-Cell-O precision ball bearings.

Dressing diamonds, which are adjustable to suit the angle of the thread form, are mounted on a slide at the front of the grinding wheel. This slide is operated by the handwheel seen at the left in Fig. 3. The periphery of this handwheel is graduated to 0.0002 inch and may be locked by means of a hand-knob to maintain a fixed position for controlling the diameter of the work being ground.

After the dresser slide is adjusted and the proper work diameter established, it is left in that fixed position; the grinding wheel is fed forward for dressing by means of a wheel-slide which is operated by the handwheel seen at the right in Fig. 3. This handwheel is also provided with a locking hand-knob to guard against accidental moving of the wheel-slide.



Seventy Years of Engineering at Lafayette College

On March 20, Lafayette College, Easton, Pa., celebrated the seventieth anniversary of its engineering course. Engineering was offered for the first time during the 1865-1866 college term, following the receipt of an endowment of \$100,000 from Ario Pardee of Hazleton, Pa. The Pardee Scientific Course which led to the degree of Bachelor of Science provided options in engineering, chemistry and mining, the term "engineering" at that time implying preparation for civil engineering. In 1871 this system was altered and the degrees of Civil Engineer and Mining Engineer were awarded.

It is of interest to note that while no formal courses leading to engineering degrees were established until 1866, the founders of Lafayette College, in their charter originally framed in 1824 and granted in 1826, specially mentioned that courses in civil and military engineering would be taught. Electrical engineering was introduced into the curriculum in 1889. The mechanical engineering department was established in 1910.

Buick's Modernization Program

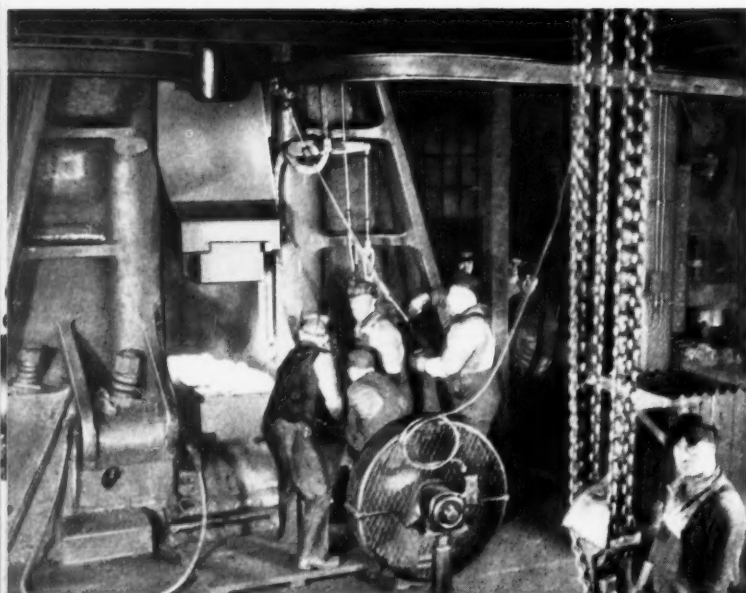
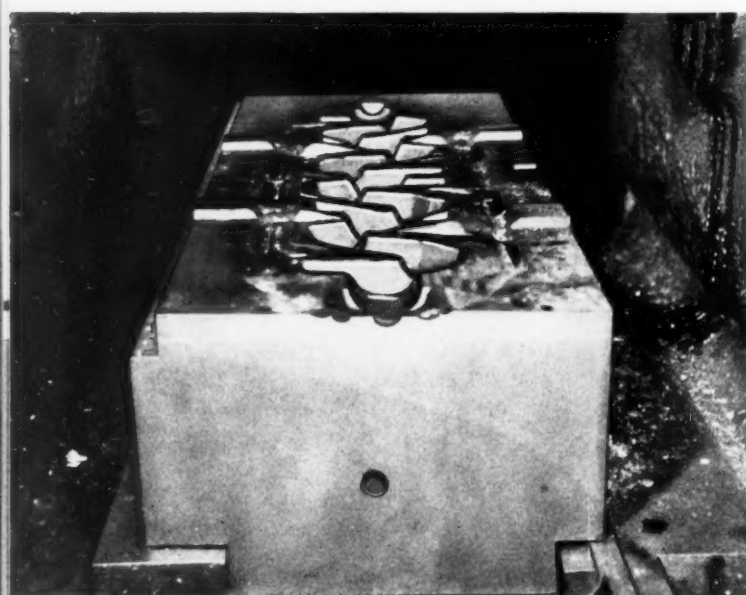


Fig. 1. Finish-forging Buick Crankshafts in a 12,000-pound Steam Hammer

Fig. 2. Close-up View of the Forging Die Used in Steam Hammer Shown in Fig. 1



INCLUDED in Buick's extensive modernization program has been an entire revamping of the forge shop. More than \$750,000 has been expended for new equipment alone, including steam hammers, heat-treating furnaces, etc. Under the new set-up, new production methods and closer quality control are provided.

Of particular interest in this modernization program is the attention given to securing closer working tolerances. For instance, the draft angles on crankshaft forgings have been reduced to 3 degrees, resulting in a considerable reduction in the amount of stock removed in the machine shop. This not only effects machining economies, but also increases the quality of the crankshafts by making possible lighter machining cuts, which cause less distortion. The procedure in forging the crankshafts and the lay-out of the machines for this work has been so planned that billets can be used instead of bar stock, thus effecting a saving.

In production, crankshaft billets are first cut to weight. They then go to the first of two new 12,000-pound steam hammers, where a three-station die performs the following operations: (1) Shape to cross-section and length; (2) throw up "balls" on the forging for the checks, flanges, etc.; and (3) rough-form or bend the shaft.

The shafts are then finish-forged in the second steam hammer, shown in Fig. 1. From ten to fifteen blows of this 12,000-pound steam hammer are required for this operation. The steam hammers are built with double-port exhausts for the steam, providing a fast exhaust of steam at the bottom of the stroke and a fast return, with the elimination of the usual dwell. The ratio of the dead weight in the base to the weight of the ram is made higher than usual to increase the anvil effect. With this equipment, the crankshaft is released quickly from the die, and the quick return permits making use of the fuel gas compression resulting from the blow to help eject the shaft.

During the forging operation, the scale is removed with a steam hose. A monorail hoist is furnished to facilitate handling the work, and a cooling fan is provided to improve operating conditions. At the right in Fig. 1 may be seen the chain block for the fixture in which the crankshafts are hung for dipping, before trimming off the flash. The cranks are partially dipped into this cooling bath, where the counterweights are quenched. This

Effects Forge Shop Economies

prevents misshaping of the counterweights in the trimmer.

Following the trimming operation, the flywheel flanges are upset at the end of the shaft. The cranks are then twisted to index the various throws to their respective angular positions. When cool, the shafts are heat-treated. After heating and before quenching and drawing, the crankshafts are "restruck" in the 600-ton hydraulic forming press shown in Fig. 3. Restriking at this point insures even temperatures and therefore consistent production accuracy, since the restrike is always at the quenching temperature. With this arrangement, the shrinkage is more uniform throughout the shaft, while subsequent straightening operations after machining are almost eliminated.

The method of quenching the crankshafts illustrated in Fig. 4 differs from conventional practice. The shafts are placed on trays which are lowered by a conveyor hoist into the quenching tank at a predetermined rate of speed, so selected as to reduce quenching distortion. This arrangement also has been found to assist materially in preventing the setting up of strains in the smaller crank sections. From the quench, the shafts go to the draw furnace to complete the operations.

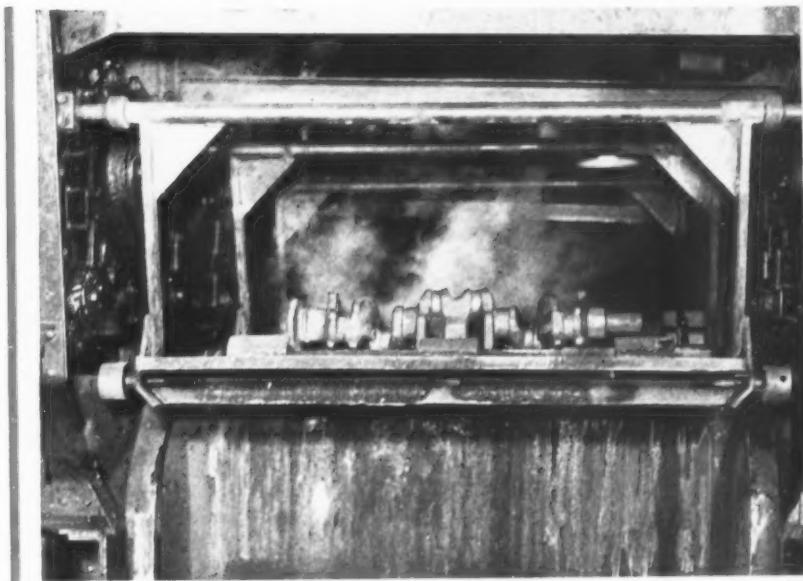
While the quality of the product is the major objective in the changes made in the forge shop, economies have also been obtained. A simple example of the thought given to this subject is found in the connecting-rod forging line. Connecting-rods, as delivered to the machine shop, are required to be within a definite tolerance for the big end bore. Since the die life under these conditions would be relatively short, a rough boring set-up has been provided in the line, so that the big ends of the connecting-rods can be bored out to specified tolerances even after the dies have worn down beyond the limits specified.

Die cost has also been materially reduced in the camshaft forge line. Instead of upsetting the end bearing on the shaft, which involves a high die replacement cost, this bearing is now "gathered" in the form of a "ball," as mentioned in connection with the crankshaft line. This is done in the first half of the camshaft forging die. The forging is done in the second part of the die, which is also used for restriking the shaft after trimming. This change has resulted in an increase of die life from 9000 pieces per die to around 20,000 pieces.



Fig. 3. Restriking Buick Crankshaft Forgings in a Hydraulic Press before Quenching

Fig. 4. Quenching Tank Equipped to Lower Crankshafts into Bath at Uniform Speed

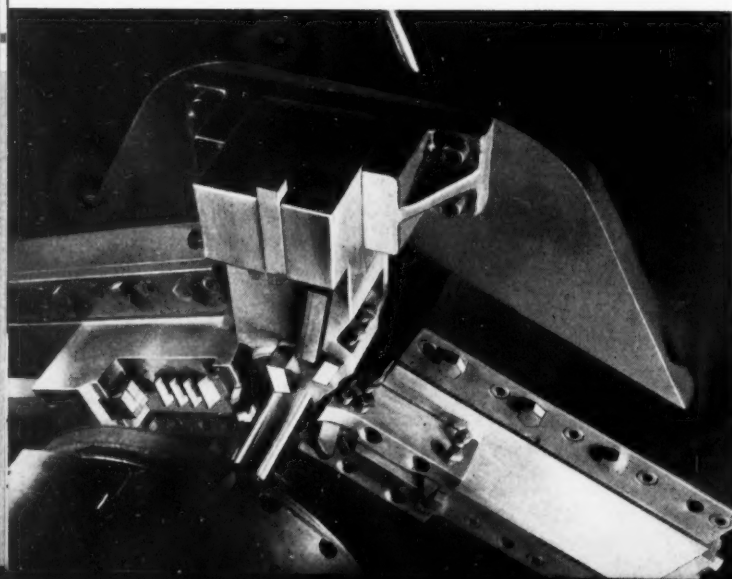


Plymouth Flywheels—44 an Hour



Fig. 1. Plymouth Flywheels are Completely Machined at the Rate of Forty-four an Hour in the Two Gisholt Machines which Replaced Three Machines that Gave a Production of Only Eighteen an Hour

Fig. 2. The Tooling Consists of a Central Boring and Turning Slide and Two Radial Slides Used for Facing, Recessing, Forming, and Chamfering Operations



PLYMOUTH flywheels are machined completely in two operations by two Gisholt Simplimatic lathes provided with radial slides that are equipped with multiple tools. These machines, which are operated by one man, have replaced the three machines previously used and, at the same time, increased production from 18 to 44 flywheels an hour, floor-to-floor time. Although the operation is only a roughing one, the flywheels are held to close tolerances.

The tooling arrangement was designed to permit the maximum number of cutting tools to operate simultaneously at high speeds. The machines are equipped with a special carriage having a vertical face on which the tool-slides are mounted, as seen in Fig. 2. The tool-slides are thus brought close to the work and can be applied without excessive overhang or interference. Cam segments on a single drum actuate the tool-slides. The segments can be changed, if necessary, to provide different feeds or a different timing of the slides for another job.

The machining cycle is entirely automatic, it being necessary for the operator to move only one lever. The carriage or master slide on which the tool-slides are mounted is traversed to within 1/4 inch of the work by an air cylinder. The cam-drum then feeds the tools to the required depth.

The tooling on both machines is similar in general arrangement. It includes a central boring and turning slide which is fed longitudinally, and two radially disposed slides on which tools are mounted for taking facing, recessing, forming, and chamfering cuts. Upon the completion of the operation, the tool-slides are returned to their radial positions on the master slide, the latter is quickly traversed back to its starting position, and the spindle is stopped. The machine is then ready for reloading.

The tungsten-carbide and Stellite J-metal tools used in these machines remove approximately 3/32 inch of stock. The cutting speed is approximately 200 feet a minute, except for the final shaving operation, which is performed at a speed of 100 feet a minute. A feed of about 0.030 inch per revolution has resulted in a long tool life between grinds.

On each machine, the flywheels are held in a three-jaw air-operated chuck. They are located on three pins in the chuck face and clamped around the circumference. The removal of metal occurs so rapidly that a 16-inch air cylinder is required on the chuck to hold the work securely.

Grinding Universal-Joint Crosses

UNIVERSAL-JOINT crosses are ground on the four ends at the rate of 500 an hour in a two-wheel machine recently built by the Hanchett Mfg. Co., Big Rapids, Mich. At this rate of production, 2000 separate surfaces are ground hourly, from 0.006 to 0.008 inch of stock being removed from each surface. The ground ends must be square with the axis of each trunnion within 0.0002 inch and true within 0.001 inch of an imaginary center line, while the over-all length of each pair of trunnions must be to size within 0.001 inch.

This operation is performed after the crosses have been hardened and the trunnions finish-ground on the outside diameter. From Fig. 2 it will be seen that the crosses are loaded for the end-grinding operation in a power-driven rotary drum which has eight work stations. Each station is provided with hardened vees for supporting the two ends of the cross that are being ground and a separate pivoting yoke into which the other pair of trunnions is placed to determine the lateral position of the cross in the vees. This locating method results in the ends being ground an equal distance from an imaginary center line extending in the opposite direction.

Each fixture station is equipped with a pivoted top clamp that passes under a stationary shoe which extends between the two parallel grinding wheels. This clamp automatically locks each piece in the fixture. Near the bottom of the grinding wheels the clamp passes off the shoe, permitting the ground piece to fall into a chute.

Before the work is unclamped, however, it passes between two automatic sizing devices which are electrically connected to the feed-screws of the grinding-wheel heads. They automatically compensate for wear of the grinding wheels.

After a quantity of crosses have been ground on two ends, the same lot is passed through the machine a second time for grinding the other ends.

The work stations are so constructed that they will take three different sizes of crosses. In order to accommodate two additional sizes, the machine was supplied with a separate drum-and-spindle assembly. The operation is performed wet.

Each grinding wheel-head is mounted on a slide that can be adjusted in any direction. The grinding wheels can be set truly parallel or with a slight clearance at the top, bottom, back, or front.

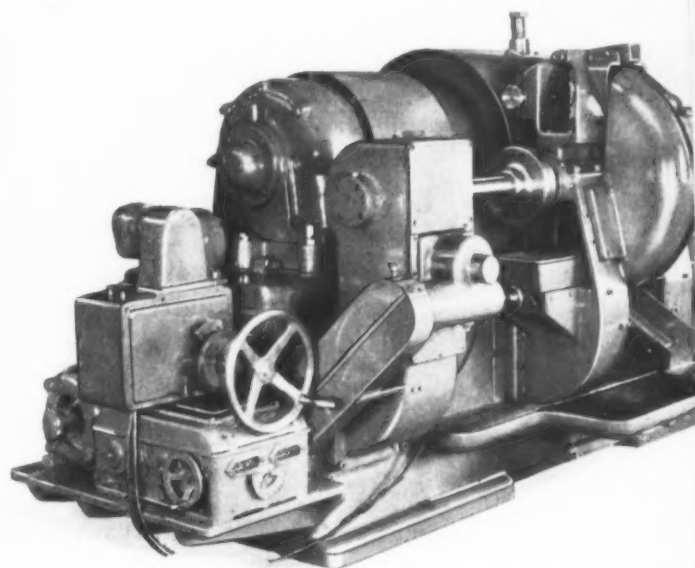
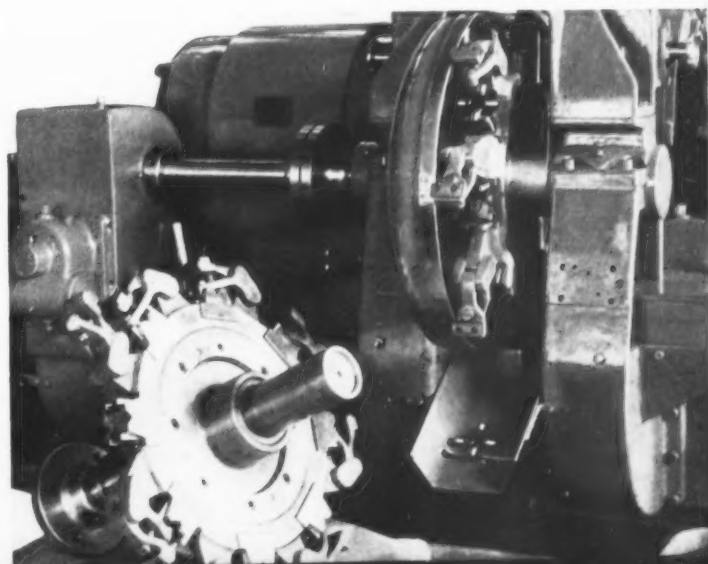


Fig. 1. Hanchett Opposed-wheel Grinding Machine Built for Accurately Finishing to Length the Four Ends of Universal-joint Crosses. Five Hundred Crosses are Ground Hourly on Their Four Ends

Fig. 2. The Universal-joint Crosses are Loaded into a Constantly Rotating Drum Provided with Eight Stations. The Pieces are Clamped Automatically



EDITORIAL COMMENT

The imagination, courage, and ability to produce results that have characterized the automobile industry from its very beginning have at no time been more evident than during the last three or four years. In fighting for national recovery, the automobile manufacturers have led all other industries.

A Great Industry that Retains Its Leadership

Confronted by discouraging business conditions and political obstacles, this industry has continued to forge ahead. Credit for this accomplishment is due equally to the industry's business leaders, its designing engineers, and its production executives.

No industry has developed a more far-reaching system of what might be termed "interlocking production." No automobile plant can have on hand a great supply of parts for final assembly. It is obviously impracticable to provide space for storing the requisite number of component parts for several thousands—not to say tens of thousands—of cars. In many instances, parts must be produced almost from day to day. Yet so remarkably is the production in the great automobile plants synchronized or interlocked that the right body, the right wheels, and the exact equipment for every car ordered by distributors and dealers arrive at the assembly line literally at almost the exact *second* when required. It would allow altogether too great a latitude were we to say at the exact *minute*, because a single minute's delay would disarrange the entire assembly schedule when one car comes off the assembly line every sixty seconds. It is doubtful if there are any industrial operations of equal magnitude that are so exactly timed.

The influence of the automobile industry on the activity and employment in other industrial fields is seldom fully appreciated. The number of car-

As a Creator of Employment it Holds the Record

loads of automotive freight shipped over the railroads runs into 3,500,000 annually. The automobile absorbs 75 per cent of all the rubber, 77 per cent of all the plate-glass, 23 per cent of all the iron and steel, 22 per cent of the copper, 39 per cent of the lead, 33 per cent of the nickel, and 59 per cent of the lubricants produced in this country. The automobile industry is the largest single user of die-castings. Practically the entire gasoline industry has been built up as a re-

sult of the automobile, which uses over 16,000,000,000 gallons a year.

The stimulus that the automobile industry has given to dozens of other branches of industry, and the millions of men and women who are indirectly finding employment because of the automobile, it is impossible to accurately estimate; but the figures quoted give an indication of what would happen if we had no automobile production to keep kindred industries going.

Once a year MACHINERY devotes a special number to this industry, and in so doing, pays its respects to the men in the production and engineering departments who, aided by the industry's business leaders, have made this great industry possible.

Although the fallacy of estimating overhead as a percentage of the direct labor cost has often been pointed out, this method of cost estimating is still in use in many plants. Leading cost accountants agree that the method is erroneous. A simple analysis of a few cases will easily prove this. Some

Overhead Should Not be a Fixed Percentage of Labor Cost

machine shop work done by skilled and highly paid labor requires comparatively inexpensive equipment; but the overhead, including interest and depreciation, would be high if figured as a direct percentage of the labor cost. On the other hand, in the automatic screw machine department, where one man runs a battery of machines, the labor cost is low while the equipment cost is high, and interest and depreciation should be allowed at a much higher rate. However, the cost accountant who figures overhead as a direct percentage of labor cost, will have much less overhead here than in the previous instance. It is a fact that frequently the overhead increases directly as the labor cost is reduced, because more expensive equipment is used.

Proper cost accounting calls for an accurate estimate of each item of cost entering into production. Accurate cost figures are impossible if all the costs are lumped together under one heading "Overhead." One shop executive recently commented on this as follows: "If you are to guess at costs anyway, why maintain an expensive cost department to do the guessing? Guess yourself. Your guess is as good as anybody's."

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers
as Typical Examples Applicable in the Construction of
Automatic Machines and Other Devices

Centrifugally Operated Starting and Over-Running Clutch

By JOHN A. HONEGGER

In Fig. 1 is shown an automatic starting and over-running clutch of the centrifugal type. It consists of the driven housing *A*, in which rotates the driving clutch member *B*. Three cavities *C* are milled in member *B* to accommodate the three sliding weights *D*. To one of these weights is riveted the spring steel band *E*. Over the steel band and riveted to it is the brake lining material *G*. At *H* is a steel thrust washer, while at *J* is a retainer plate for keeping both halves of the clutch assembled.

The operation of the clutch is as follows: As the clutch is rotated by the driving member *B*, centrifugal force causes the weights *D* to move outward. This, in turn, expands band *E*, forcing the brake lining into contact with the inner surface of housing *A*. As long as the speed of driver *B* is maintained or increased, the gripping force is also maintained or increased, but the moment it is reduced, either from the slowing up of the driving force or because of resistance set up in the driven member, the sliding weights are forced inward by the spring band *E*, immediately disengaging the clutch and allowing half of the clutch to slip upon the other half. If the driving force is entirely cut off, the clutch

disengages, allowing the driven half to over-run until it comes to rest.

Simplicity of construction and a large contact area are advantages of this clutch. It should be noted that the effective gripping power can be increased without increasing the diameter by merely lengthening the clutch. It should also be noted that, for a given velocity, the force exerted is proportional to the mass of the weights *D*, so

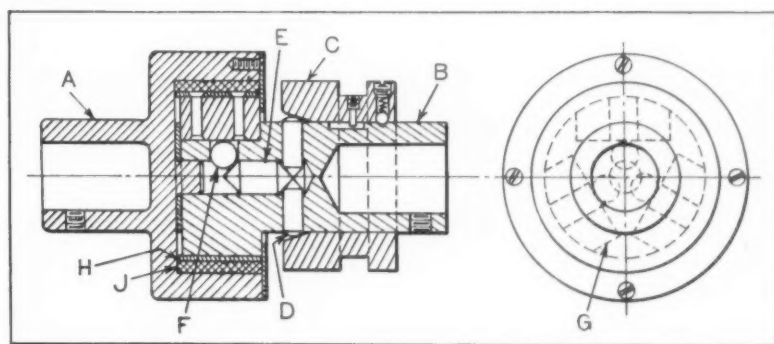


Fig. 2. Modified Design of Clutch Shown in Fig. 1

that the larger the housing of the clutch, the greater will be the gripping force.

This type of clutch can also be made in the form of two halves of a brake-shoe, a centrifugal weight being used to force the two halves apart. However, this type of construction would involve a problem of dynamic balancing.

Fig. 2 shows the same type clutch employed in the reverse manner. Here the housing *A* serves as the driver, the driven member being the housing *B*, which is caused to rotate when the clutch collar *C* is forced over the pins *D*. These pins, of which there are three, force the connector pin *E* against the three steel balls *F*. Pins can be used in place of the balls, if desired.

The balls *F* force the three equally spaced sliding blocks *G* outward, causing the spring steel band *H* to expand, so that the brake lining material *J* will grip the outer housing, thus connecting the driving and driven members. The screw-pin is for the purpose of connecting the shaft collar *C* to the housing *B*,

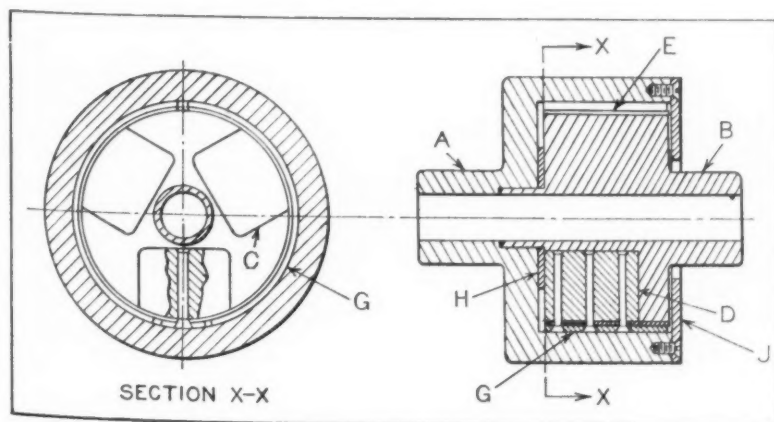


Fig. 1. Automatic Starting and Over-running Clutch

while the ball spring arrangement is provided to hold the shaft collar in either the open or the closed position.

Mechanism for Stacking Articles at the Delivery End of a Conveying Belt

By F. R. ZIMMERMAN

The basic mechanical motion used in the mechanism here illustrated has various applications and should be of interest to machine designers. In this case, it is applied to the problem of stacking articles which are being carried along a conveyor belt. Its advantage for this work is that it will handle articles which are being received in varying quantities or singly, as the case may be. In this instance, the articles, shown by dot-and-dash lines, are stacked five high and are discharged on a roller conveyor as shown.

The operation of the mechanism is based on the "firing" of a trigger *T* which is moved to the position shown by the dotted lines by a single article, which will then allow the conveyor belt to slip or pass beneath until the elevator *K* rises to the upper position, indicated by the dotted lines. This places the article at the bottom of the preceding articles which make up the stack. The article is prevented from dropping back by four latches *U* which are hinged in the side walls. Each article, of course, supports the one above it until the pile is complete, when the entire stack is moved to the right.

The action of the lower part of the mechanism is as follows: An oscillating movement is imparted to the rocker arm *OL* by the driver shaft which rotates continuously. This shaft carries an eccentric *E* and, in turn, is connected to arm *OF*. This arrangement causes arm *OL* to oscillate through the angle α . The secondary arm *HLW*, which is carried on arm *OL*, will pick up plate *P* under certain conditions, to be described, and swing arms *OA* and *SB* to their upper positions.

It is, of course, understood that these arms carry the elevators *K* and that the "pick up" action is accomplished as a result of the "firing" of the trigger *T* which allows the catch arm to drop off the small pin *E* and the lower end *R* to assume the position shown by the dotted lines. The cam arm *YC* and arm *YR* are tied together and turn or swing as one piece on the pin *Y* fixed in the frame. Part *HLW* also carries a small pin *D* which strikes roller *R*, and when in the lower position, locks into plate *P* on the upward part of the oscillating movement of arm *OL*. At the same time, cam *C* is moved to the position indicated by the dotted lines to the left. This action relatches the trigger *T* on pin *E* if no article is in position to be raised to the stack.

The discharge action may be arranged to take place on the return or downward part of the stroke. When the fifth article has raised arm *J*, the latter arm, which is connected to a bolt clutch

finger of standard design, causes the part indicated at *Z* to rotate one complete revolution. Through suitable connections, which are clearly indicated, this action moves pusher *G* to the position indicated by the dotted lines at *G*₁ and returns it to its normal position. This movement transfers the stack of five pieces to the roller carrier and completes the cycle, after which the operations are repeated automatically.

* * *

The Use of Machine Equipment Aids Employment

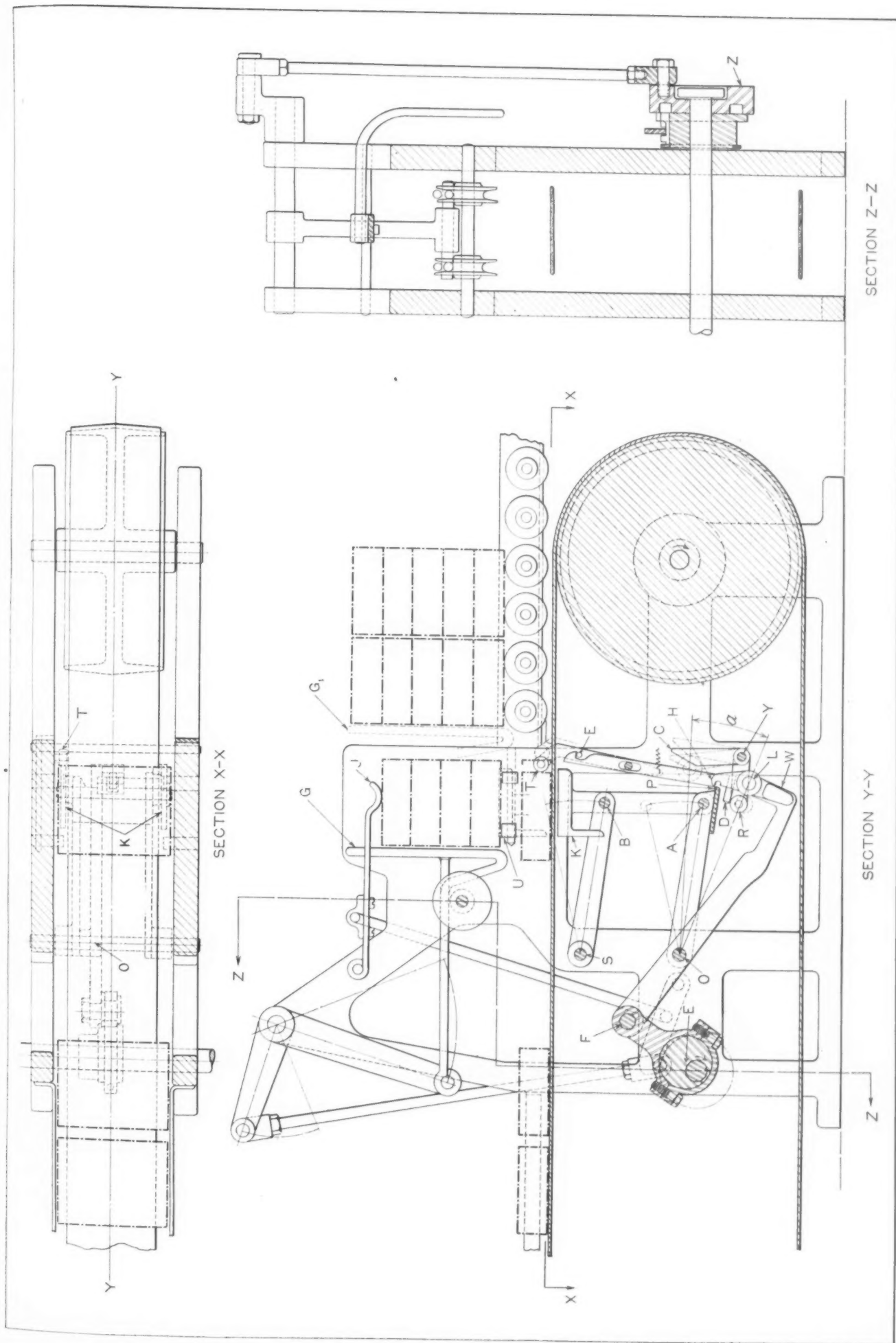
An analysis of current employment statistics reveals that employment is higher in intensely mechanized industries, compared to predepression levels, than it is in occupations in which few or no machines are used. These facts were cited by the Machinery and Allied Products Institute in connection with its study of technological advancement, which shows that machines increase rather than decrease employment opportunities. Great mechanical progress has been made in printing machinery, for example, during recent years, yet employment in newspaper and periodical publishing is at 102.4 per cent of the 1923 to 1925 average, according to the United States Bureau of Labor Statistics, which uses the 1923 to 1925 period as 100 per cent, or "normal." Almost without exception, in those industries where machine methods have been developed to a high degree, the volume of production has increased to such an extent that more workers are needed.

Examination of all industries upon which the Government reports shows that those which have the lowest employment figures are dependent upon the revival of building construction. We all know that in the building industry, hand labor is still a most important factor, and that the unemployment in the building trades cannot be charged to the use of machinery.

* * *

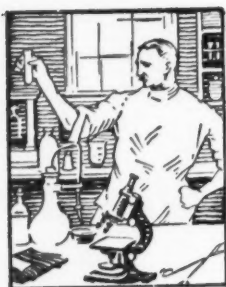
Preparing Shipments for Export

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has prepared a handbook for exporters entitled "Preparing Shipments to Europe." This book contains a great deal of definite information relating to the handling of an export shipment. It gives, in a brief and concise manner, the information required for properly preparing and forwarding foreign shipments. It is known as Trade Promotion Series No. 158, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the district offices of the Bureau of Foreign and Domestic Commerce located in the principal cities throughout the country. The price is 15 cents.



Stacking Mechanism at End of Conveyor Belt which Raises Pieces from Belt, Arranges them in Stacks, and Transfers the Stacks to a Roller Carrier

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES



Acid-Resisting Plastic Material of Light Weight

A Durez material has been developed by General Plastics, Inc., North Tonawanda, N. Y., for molded parts that must have the properties of acid resistance, frictional wear resistance, and low water absorption. This new material, which is known as "77 SB Black," has a weight of only 20.6 grams per cubic inch, or a specific gravity of 1.26. It can be machined, sanded, and buffed after molding without exposing spots of filler or impairing the acid- and friction-resistant qualities.

One Hundred Kinds of Steel in Today's Automobiles

The importance of alloy steels in automobile construction was strikingly illustrated in a recent speech made by J. M. Watson, metallurgist of the Hupp Motor Car Corporation. Mr. Watson pointed

out that the Society of Automotive Engineers, in an investigation conducted in 1911, found that eighteen different kinds of steel were being used at that time in automobiles. Seven of these steels were carbon steels, and eleven alloy steels. The 1935 report of the Society showed that 109 different steels were being used in automobiles. Ten nickel steels and twenty-two nickel-chromium steels were included in the latest list.

Treating Ferrous Metals to Resist Corrosion, Heat, and Wear

Ferrous metals can be impregnated with silicon in such a way as to form an outer case of almost any desired thickness by a process known as "Ihrigizing," which was recently invented by Dr. Harry K. Ihrig of the Globe Steel Tubes Co., Milwaukee, Wis. The case obtained with this process is said to contain approximately 14 per cent silicon and is integral with the treated part. The process



Stainless steel sheet over 17 feet long by 6 feet wide. It is believed to be the largest sheet of this material yet produced. The thickness is $3/16$ inch, and the weight 810 pounds. Fifteen sheets of these dimensions were made by the Allegheny Steel Co., Brackenridge, Pa., to form the bottom of kettles that are used in dyeing textiles.

Cast, heat-treated, austenitic manganese steel wheels of a new design, brought out by the American Manganese Steel Co., Chicago Heights, Ill., for traveling cranes. This wheel is cast with two walls



that are continuous with the flanges. The construction is said to provide a strong but elastic support and to offer high resistance to side thrusts. The walls are tied together with internal cross spokes.

makes it possible to machine, cast, or forge parts from a cheap base metal to almost any desired form, and then treat them to resist corrosion, heat, and wear.

Ihrigized parts have satisfactorily resisted diluted nitric, sulphuric, hydrochloric, phosphoric and acetic acids in laboratory and service tests. They do not scale at temperatures as high as 1800 degrees F., even in highly oxidizing atmospheres.

While not file hard, Ihrigized parts cannot be cut with a hacksaw. The hardness ranges from No. 148 to 163 Brinell. Service tests of Ihrigized automobile-engine cylinder liners have shown them to be highly resistant to wear. Tensile tests on standard bars have shown an elastic limit about the same as that of untreated bars, and the silicon case does not crack until the elastic limit has been exceeded by several thousand pounds per square inch. The ultimate tensile strength is somewhat less, because the cracked case reduces the cross-

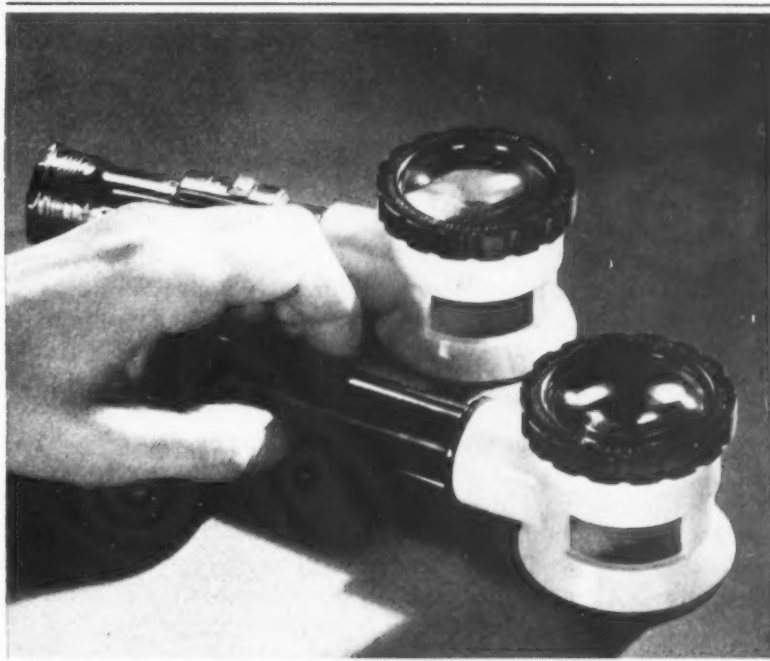
sectional area, but if the core section alone is considered, the tensile strength is the same as that of the original metal.

Ihrigized parts can be ground if necessary, but they cannot be otherwise machined or fabricated.

One-Half of All the Nickel Produced is Used in the United States

Practically one-half of all the nickel produced annually in the world is consumed in the United States, according to Thomas H. Wickenden, assistant manager of development and research of the International Nickel Co., Inc., 67 Wall St., New York City. The largest industrial user in this country is the automotive industry, although the machine tool, railroad, oil, mining, radio, and electrical industries also use considerable amounts.

A magnifying device with an electric light bulb for illuminating the field of vision, known as the Flash-O-Lens, is a product of E. W. Pike & Co., Elizabeth, N. J. The spacer ring which holds the double lens in focus is Bakelite Molded, the handle jet black Bakelite, and the housing white Plaskon. These parts are made by the Boonton Molding Co., Boonton, N. J.



Questions and Answers

Trepanning Large and Long Forgings

B. C. C.—I would like to know if any of the readers of MACHINERY who have carried out trepanning operations on large and long forgings could give some information as to tool-heads and machines suitable for such work. The operations in question involve the trepanning of holes with diameters from 4 to 10 inches, and lengths from 20 to 40 feet.

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

ders. Moreover, an order signed by the salesman and the purchaser is not an enforceable contract until the salesman's employer sends his acceptance of the order. Therefore, either the buyer or the salesman's employer can cancel an order given to a salesman, provided the cancellation is given at any time previous to acceptance of the order by the seller.

However, an employer is liable on contracts made by a salesman if the employer informs prospective purchasers that his salesman is authorized to make valid contracts, or if in the past, the employer has led the purchaser to believe that the salesman had such unusual authority.

Firm's Liability for Contracts Made by Employees

G. E. T.—Will you please give me information as to when, and under what circumstances, a firm is liable on a contract made by an employee, such as a manager or a salesman?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Generally speaking, an employer is liable for all contracts made by the manager of a department, so long as such contracts are within the scope of his authority. A contract is valid and binding on the employer, although the manager is not specially authorized to make the contract, provided it is within his general authority and relates to the conduct of the business.

For instance, in the case of *Municipal v. Zachry* [294 Pac. 114], it was disclosed that the local manager of a branch of a corporation entered into a contract by the terms of which he employed an attorney to represent the corporation in legal matters. Later, the corporation refused to pay the bill presented by the attorney on the grounds that the manager had exceeded his authority in entering into the contract without having the approval of the board of directors of the corporation. The corporation further alleged that the manager was without authority to make employment contracts. However, the lower Court held the corporation liable for services rendered by the attorney, and the higher Court upheld this decision. Of course, an employer can limit the authority of any employee by giving notice of this limitation.

This same law does not hold with respect to a salesman. A salesman is a special agent whose implied authority is limited to the performance of a single act—the special service of soliciting or-

Lubricating an Air Compressor

W. D. L.—We have an air compressor, in the crankcase of which we use a light engine oil. This oil is also used for general mill shaft and bearing lubrication. We find that the oil is coming out into our air lines, resulting in a thick oily deposit in the apparatus using the air. Apparently the oil volatilizes as well as carburizes on the valves. The air pressure is maintained at 90 pounds. Will you recommend a suitable oil for this service?

Answered by the Editor of "Oil-Ways,"
Published by the Standard Oil Co. of New Jersey

When the same oil is used in an air compressor as is used for general mill shafting and bearing lubrication, some difficulty is ordinarily encountered. The lubricants that are usually sold for general shafting and bearing lubrication do not necessarily possess the qualities that are desirable in an air-compressor oil, and, of course, are not so expensive. Such "general-purpose" lubricants are not designed to withstand conditions as severe as those prevailing in air-compressor service. As a result, they do not resist oxidation and deterioration to a great enough degree, they usually contain fairly large quantities of carbon and are subject to volatilization at the temperatures encountered in certain portions of the air-compressor cylinders.

An oil refined from a fine paraffin base crude, and processed to provide low carbon content, high flash point, and resistance to oxidation and deterioration in service, is recommended.

NEW TRADE



LITERATURE

Hacksaw Blades

HENRY DISSTON & SONS, INC., 406 Tacony, Philadelphia, Pa. Folder entitled "Disston Hacksaw Blades—Their Selection and Care," describing hacksaw blades made for both hand and machine use. The folder covers the kinds of steel used for these blades; their characteristics; blades recommended for specific work; pointers of value in selecting hacksaw blades for various purposes; suggestions for the care of blades; and a list of the common abuses of power hacksaw blades.

Saws and Files

SIMONDS SAW & STEEL CO., Fitchburg, Mass. "Simonds Shop Notes" is the name of a new publication issued by the company, the first number of which appeared in March. This publication contains useful information for executives in metal-working plants and will be sent regularly to those requesting it. The first number deals with tooling an engine lathe; drilling thin sheet metal; sharpening tool bits; preventing rust; fabricating blanking tools; and many similar subjects.

Precision Measuring Instruments

FEDERAL PRODUCTS CORPORATION, 1144 Eddy St., Providence, R. I. Catalogue illustrating and describing the company's line of indicators, including the Model 95 clear vision type indicator and the Model 110 comparator. The catalogue also covers a stress gage for determining the compressibility of semi-hard materials; a gage for checking spools for thread manufacturers; and a gage for checking the serrations of thread dies.

Diemaking Metal

CERRO DE PASCO COPPER CORPORATION, 44 Wall St., New York City. Bulletin describing a material and a method for locating and securing punches in the punch plates of blanking, piercing, and trimming dies. This bulletin explains how the material used, known as "Cerromatrix," has greatly reduced the cost and

*Recent Publications on
Machine Shop Equipment,
Unit Parts, and Materials.
Copies can be Obtained
by Writing Directly to
the Manufacturer.*

time involved in diemaking. It describes the properties of Cerromatrix, gives detailed instructions for using it, and shows typical applications.

Bearings and Bearing Metals

BUNTING BRASS & BRONZE CO., Toledo, Ohio. New catalogues of standardized bearings and bearing metals, covering practically all types of equipment and replacement requirements in the general mechanical and electric motor fields. Hundreds of sizes of finished bronze bearings from 1/4 by 3/8 by 1 1/4 inches to 4 by 4 1/2 by 7 inches, as well as motor bearings for all motors from 1/40 horsepower to 60 horsepower, are available from stock.

Lubrication

PYROIL CO., 936 La Follette Ave., LaCrosse, Wis. Report on the beneficiation of lubricating oils with Pyroil for lubricating cadmium-silver, copper-lead, and babbitt metals. The report comprises six pages of text matter, six pages of photomicrographs, and a chart. It clearly indicates the various degrees of chemical and mechanical attack on different metals and its control under varying load and temperature conditions.

Texrope Drives

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin 1261, illustrating and describing the new Vari-Pitch Texrope sheaves which provide a simple variable-speed device. The bulletin describes not only the

stationary controlled type, but also the motion controlled type, together with the company's new Straitline automatic ball-bearing motor base, permitting complete adjustment during operation.

Diemaking Equipment

CONTINENTAL MACHINE SPECIALTIES, INC., 1301 S. Washington Ave., Minneapolis, Minn. 12-page catalogue entitled "The New Machine Tool that Modernizes Diemaking," describing and illustrating the "Do-All" tool-room machine for internal or external continuous sawing and filing. Illustrations and applications are given, as well as a chart of cutting speeds and other useful data.

Bronze-Welding

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City. Booklet entitled "How to Bronze-Weld," giving detailed information on bronze-welding and bronze-surfacing. The step-by-step procedure in bronze-welding and bronze-surfacing is covered; the choice of welding rods is dealt with; and complete information is given on the application of the process for different purposes.

Stainless Steel

LUDLUM STEEL CO., Watervliet, N. Y. Catalogue entitled "New Ways to Increase Sales and Profits with Silcrome Stainless Steel." This book illustrates a wide variety of applications of Silcrome stainless steel and contains many suggestions of interest to designers and engineers for product improvement and the development of new products through the use of stainless steel.

Speed Reducers

D. O. JAMES MFG. CO., 1120 W. Monroe St., Chicago, Ill. Folder illustrating and describing speed reducers of all types, for a great variety of purposes, twenty-two different classes of speed reducers being shown. Attention is also called to the various types of gears made by the company, including every type of gearing, as well as flexible and universal couplings.

Nickel Steel and Iron

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Circular chart for use in the selection of alloy steels for different purposes. Similar circular chart for the selection of nickel cast iron for different applications. Also vest-pocket chart showing the approximate relations between Brinell, Rockwell, and Shore hardness values.

Photographic Arc Lamps

C. F. PEASE CO., 813 N. Franklin St., Chicago, Ill. Catalogue containing data on Pease "Heliolite" open-flame and "Super-Actinic" enclosed arc lamps for all photo-mechanical reproduction purposes. Bulletin describing the special features and application of the "Heliolite" 35-ampere open-flame camera arc lamp, with telescoping standard.

Valves

INGERSOLL-RAND CO., Phillipsburg, N. J. Bulletin illustrating and describing the "Channel Valve," a new development in valve design that promises to be of great importance to air- and gas-compressor users. The bulletin is printed in a most unique manner, giving a very clear idea of the construction and action of the valve.

Silent Chain Drives

LINK-BELT CO., Indianapolis, Ind. 32-page book No. 1725, with thirty illustrations, dealing with Silver-streak silent chain drives obtainable from stocks carried at the company's warehouses, including drives from 1/2 to 60 horsepower. Complete details are tabulated for the wheels and chains constituting each drive.

Variable-Speed Transmissions

OILGEAR CO., 1310 W. Bruce St., Milwaukee, Wis. Bulletin 60,000, covering Oilgear fluid-power variable-speed transmissions, illustrating and describing the design, construction, and operation of these variable-speed drives, and giving complete information as to the capacities, types, and sizes available.

Welding Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Catalogue 101 entitled "Airco Electric Welding Products," illustrating, describing, and listing electric welding rods, supplies, and Wilson electric welding machines. The catalogue contains much useful information to welders.

Carburizing Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Folder entitled "Union Hymo for Gears and Shafts," describing a carburizing steel that reacts with great uniformity to the casehardening process. It is also a free-cutting steel, approaching Bessemer screw stock in machineability.

Lathe Turrets

MONARCH MACHINE TOOL CO., Sidney, Ohio. Bulletin S-2, illustrating and describing the Monarch rear necking, chamfering, and forming turret, which is mounted on the back of the compound rest. This turret makes it possible to avoid second operations on many types of work.

Zinc-Base Die-Cast Alloys

APEX SMELTING CO., 2554 Fillmore St., Chicago, Ill. Metalgrams Nos. 6 and 7, containing charts giving the tensile strength and stability, respectively, of No. 3 zinc-base die-cast alloy for different die and metal pressures and temperatures.

Synthetic Rubber

THIOLKOL CORPORATION, Yardville, N. J. Booklet entitled "A Rubber Plantation in New Jersey—the Story of Synthetic Rubber," presenting briefly and interestingly this remarkable new development in producing an industrial material.

Material-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Circular illustrating applications of Cleveland tramrail switches for the overhead handling of materials or products in a variety of industries.

Optical Inspection Instruments

E. LEITZ, INC., 60 E. 10th St., New York City. Pamphlet 7229, containing data on Leitz profile (contour) projectors for inspecting and measuring contour forms, such as screw threads, gear teeth, etc.

Speed Reducers

JANETTE MFG. CO., 556 W. Monroe St., Chicago, Ill. Bulletin 22-3, announcing the latest additions to the line of Janette motorized speed reducers.

Spray Nozzles

CHAIN BELT CO., Milwaukee, Wis. Bulletin 278, entitled "Rex Flat Spray Nozzle," illustrating and describing corrosion-resisting nozzles

for washing and cleaning in the industrial field.

Type-Holders for Marking

JAS. H. MATTHEWS & CO., 480 Canal St., New York City. Circular illustrating and describing Matthews Champion holders for type used for stamping or marking metal products.

Expansion Bolts

RAWLPLUG CO., INC., 98 Lafayette St., New York City. Loose-leaf book entitled "Architectural and Engineering Data on Expansion Bolts for Holding to Masonry."

Electric Motors

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo. Bulletin SD-549, entitled "Service Instructions for Capacitor-Start Induction-Run Motors."

Precision Measuring Blocks

FORD MOTOR CO., JOHANSSON DIVISION, Dearborn, Mich. Circular containing tables of constants for setting Johansson 5-inch sine bars to the desired angles.

Tool-Room Control

MCCASKEY REGISTER CO., Alliance, Ohio. Folders entitled "McCaskey Tool-Room Control—Fix Tool Responsibility," and "Improve Your Control Methods."

Cleaning Barrels

PANGBORN CORPORATION, Hagerstown, Md. Folder illustrating and describing the Pangborn airless Roto-blast cleaning barrels.

Belt Drives

NUCORD CO., 605 W. Washington Blvd., Chicago, Ill. Folder describing the construction and advantages of "Nucord" multiple flat belt drives.

Alloy Steels

REPUBLIC STEEL CORPORATION, Republic Bldg., Cleveland, Ohio. Folder calling attention to the use of alloy steels in automobiles.

Lockers

ALL-STEEL-EQUIP CO., Aurora, Ill. 16-page catalogue illustrating and describing a new line of lockers.

Electroplating Equipment

UDYLITE CO., Detroit, Mich. Folder entitled "Economical and Efficient Plating with Ball Anodes."

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Hydraulic Planer Brought Out by the Rockford Machine Tool Co.

The "Hy-Draulic" shapers and shaper-planers built by the Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill., have been supplemented by the planer shown in Fig. 1, which can be built with a bed from 23 to 45 feet long and a table from 12 to 22 feet in length. Table widths of 36 or 42 inches can be supplied. The maximum distance from the table to the under side of the cross-rail is 37 1/2 inches.

The table of this machine is reciprocated by hydraulic power, thus eliminating a considerable number of heavy links, gears, etc., from the table drive. Hydraulic power provides a smooth powerful cutting stroke, which can be adjusted instantly to any desired rate within the capacity

of the equipment. The life of tool cutting edges is lengthened, "gear marks" are eliminated on the work, and chatter is prevented.

The cutting speed of the table reaches the established rate almost instantly upon reversal, and remains constant throughout the entire stroke. Table reversals occur without shock, and the rapid return of the table is constant, regardless of the cutting speed. Cutting speeds of from 0 to 50 feet per minute are available, and return speeds of from 10 to 150 feet per minute.

Hydraulic pressure is also employed for feeding the heads. The feeds, like the cutting speeds, can be adjusted instantly to any desired amount within

the capacity of the machine. The feeding movement is smooth and rapid. Horizontal feeds of the rail head from 1/42 to 1/2 inch are available, and vertical feeds from 1/96 to 1/4 inch. Vertical feeds of the side head range from 1/48 to 1/2 inch. Horizontal feeds can also be supplied for the side head.

The rail-head slides can be adjusted 11 1/2 inches vertically, and the side-head slides 11 inches horizontally. There is a power rapid traverse for the rail heads in both directions, and for the side head vertically.

From Fig. 1 it will be seen that the main driving motor, which is located at the right-hand end of the machine, is direct connected to the hydraulic

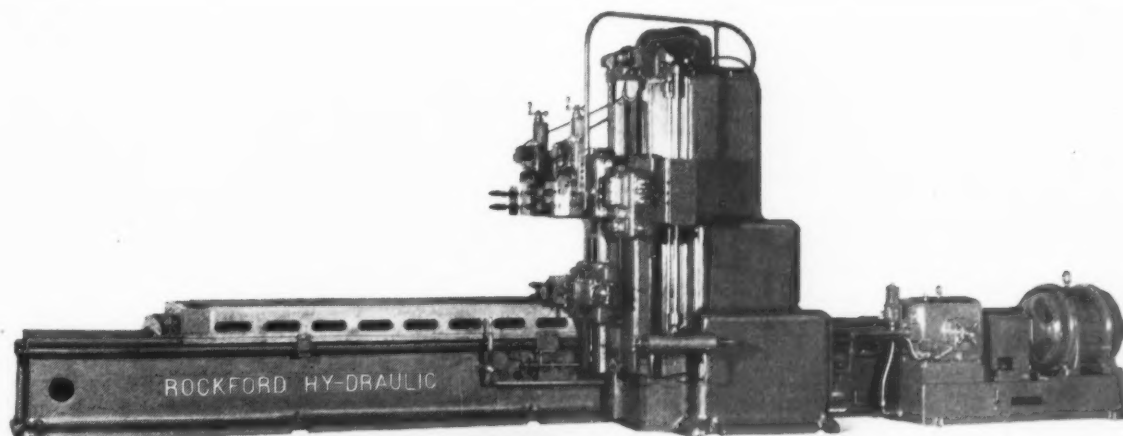


Fig. 1. "Hy-Draulic" Planer Brought out to Supplement the Shapers and Shaper-planers Built by the Rockford Machine Tool Co.

SHOP EQUIPMENT SECTION

power unit. Both are mounted on a heavy base, giving a compact arrangement which reduces the number and length of hydraulic connections, eliminates vibration, provides accessibility, and insures ample ventilation. Handwheels on each side of the hydraulic unit enable the operator to readily adjust the cutting speeds and the rapid return.

One of the important features in the construction of this planer is that the cross-rail is integral with a long and wide vertical bearing or slide on the column, the casting resembling a heavy inverted letter "L," as will be seen from Fig. 2. The bearings of this slide are machined and scraped. The slide is provided with a narrow guide and a tapered gib. Mounted on this slide is a side-head rail which is pivoted at its upper end and provided with a fine adjustment at its lower extremity. This construction provides a permanent means for accurately aligning

the side-head rail. It is secured in position by tightening heavy bolts. Although heavier in its details, the design of this unit follows a similar arrangement on the shaper-planer built by the concern.

Mounted on top of the column is the motor-driven mechanism which provides rapid traverse to all heads and power elevation of the rail. The electrical and hydraulic control panels are mounted on the cross-rail. Pendant *P* contains push-button controls which establish the direction of rapid traverse for the rail head, a master motor switch, and a rod by means of which the machine can be stopped instantly. The three levers *A* provide a complete control for the power-operated movements of both rail heads, including the feed or rapid traverse to the left or right, up or down, separately or in unison. Similarly, lever *B* controls the vertical movements of the side head.

By means of ball crank *C*, the operator can instantly obtain any desired feed rate. Lever *E* starts and stops the table movement, while lever *D* reverses its direction. Both of the rail heads are equipped with devices which automatically raise the tools out of contact with the work during the return stroke.

The open-side construction of the planer is clearly shown in Fig. 3. The cross-rail is supported by a back brace of rigid box section having a broad base and heavy locking bolts. This illustration also shows the duplicate controls on the opposite side of the bed from that seen in Fig. 1, which provide for starting, stopping, and reversing the table movements. A heavy sheet-metal cover extends the entire length of the bed between the ways.

Planers of this general design can be supplied with a double housing and in larger sizes if desired.

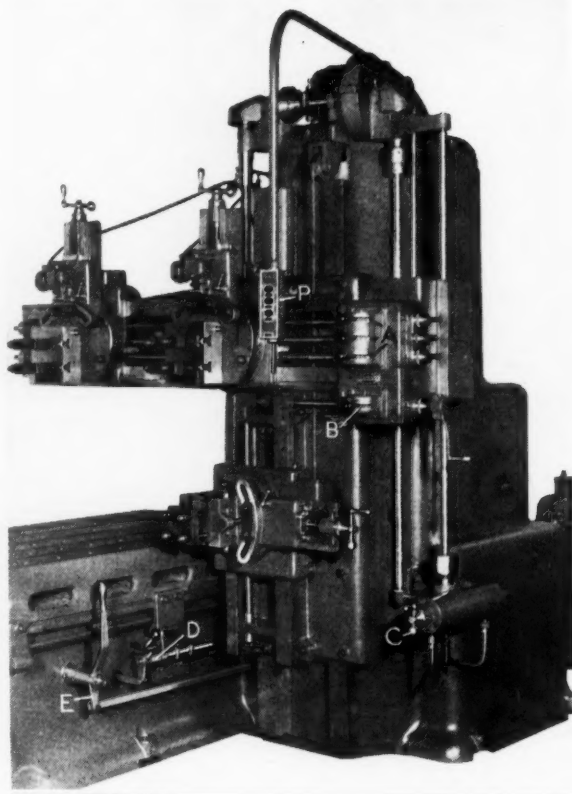


Fig. 2. The Cross-rail Casting of the "Hy-Draulic" Planer is Integral with the Long Vertical Slide on the Column

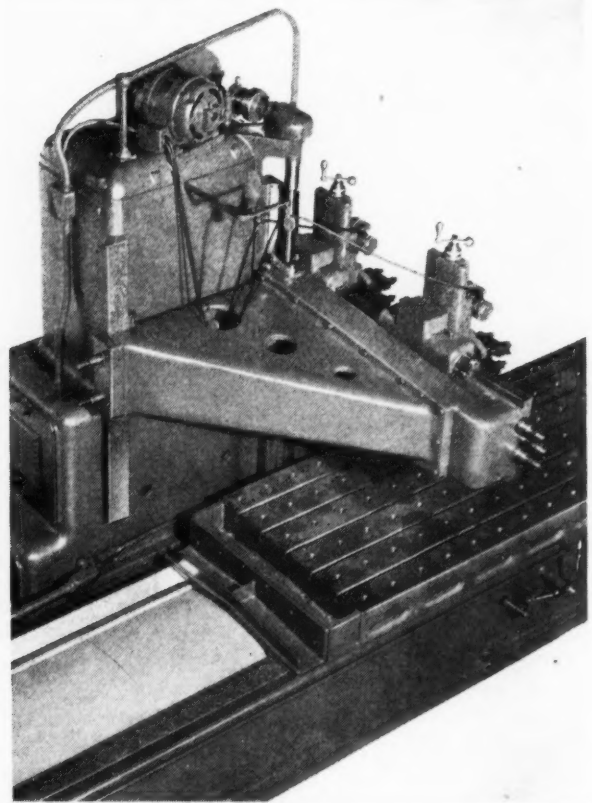


Fig. 3. The Cross-rail is Supported at the Back by a Brace of Rigid Box Section which Spans the Deep Column

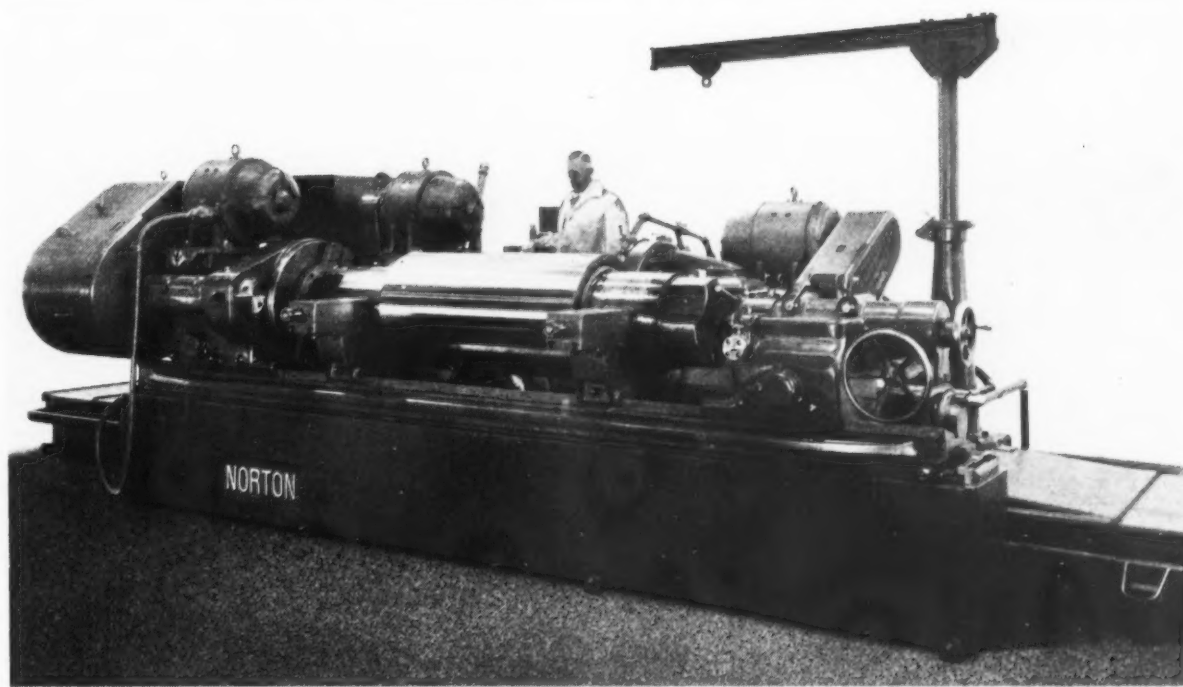


Fig. 1. Norton Grinding Machine Designed Primarily for Finishing the Rolls of Mills that Produce Steel Sheets for Automobile Bodies and Fenders

Norton 36-Inch Roll Grinding Machine

A machine designed primarily for finishing large and medium-sized rolls, such as are used in mills for the production of steel sheets for automobile bodies and fenders, has recently been added to the extensive line of grinding machines built by the Norton Co., Worcester, Mass. Either straight or formed rolls can be ground in this machine to a fine finish and within unusually close limits of accuracy as regards both size and contour. This machine, which is shown in Fig. 1, is of the traveling wheel type, and has a normal swing of 36 inches over the work-table. It is built in lengths of from 144 inches upward. The weight of a 36-inch by 144-inch machine is approximately 100,000 pounds.

The base is a single casting that supports the work-table and the traveling carriage on which the grinding wheel unit is mounted. A standard headstock, footstock, and journal rests for supporting the roll to be ground are provided on the table. The headstock is driven by a 15-horse-

power adjustable-speed motor which provides a wide range of work speeds. The speed reduction from the motor is through multiple V-belts, the final drive to the equalizer drive-plate being through a silent chain which operates in an oil bath. The footstock is equipped with a large sliding spindle that is easily moved, even when heavily loaded, because of the ball thrust bearing and worm reduction provided for the handwheel.

The wheel carriage is traversed back and forth by a five-horsepower reversing motor. It travels on wide ways and is lubricated by a force-feed system. The operator rides on the wheel carriage during grinding, standing on a non-slip floor in a centralized position within easy reach of all operating controls. This station is illustrated in Fig. 2. From this point, the operator can always observe the contact of the grinding wheel with the roll.

The grinding wheel unit is composed of two parts, an upper

and a lower portion. The upper portion carries the wheel-spindle and its 25-horsepower adjustable-speed driving motor. The lower portion slides on widely separated ways, one flat and one of the vee type, which are also lubricated by a force-feed system. The movement of the wheel unit toward or away from the work is accomplished by means of a large-diameter feed-screw, which is mounted on ball bearings and runs in an oil bath. A rapid power-traverse mechanism which is motor-driven enables the wheel-head to be traversed at the rate of 48 inches a minute. This permits rapid settings of the wheel for grinding to different diameters.

The cambering device is of the pivoted wheel type. Pivoting occurs on two large trunnions at the front of the slide directly below the wheel-spindle. The tilting motion is caused by a rotating cam, operated from the carriage traverse rack through a train of gears. Relative longitudinal motion between the grinding wheel and the roll

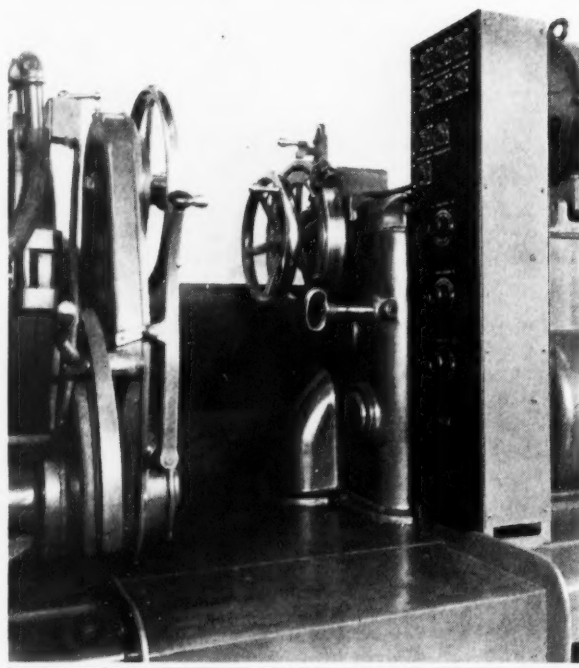
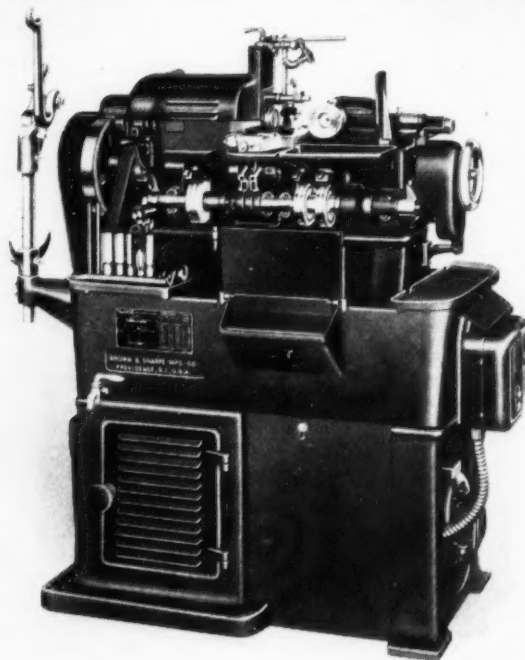


Fig. 2. The Operator's Station on the Norton Roll Grinding Machine



Brown & Sharpe No. OOG Automatic, Redesigned for Higher Speeds and Increased Capacity

causes rotation of this cam against a roller on the upper wheel-head member. The rear of this member is thus raised and lowered to move the wheel face in and out. This causes the roll to be ground to a form that is determined by the shape of the cam and the change-gears used. A chart is provided to show the settings for producing different amounts of curvature.

Rapid Pressure Booster for Testing Gages

A hydraulic pressure booster designed for testing gages, castings, connections, and pressure vessels in the shop or laboratory has been developed recently by the Martin-Decker Corporation, Long Beach, Calif.

This booster consists of a low-pressure cylinder to which is connected a line from the plant water or air supply system, and a high-pressure cylinder, the outlet of which is connected to the gages or lines to be tested. Pressures can be built up to 5000 pounds per square inch at a slow rate or rapidly.

Brown & Sharpe High-Speed Automatic Screw Machine

Several important changes in design, together with numerous minor structural changes, have been made recently in the No. OOG automatic screw machine built by the Brown & Sharpe Mfg. Co., Providence, R. I. This machine is designed for high-speed operation and for motor drive only. One of the most important changes is an increase of 20 per cent in the spindle speeds. Thirty-six changes in spindle speeds, obtained by change-gears, are now available, covering a range extending from a new low speed of 200 revolutions per minute to a new maximum speed of 6000 revolutions per minute. Improvements have been made that permit of changing speeds more quickly and easily. Metal plates with diagrams and charts of the speed and feed change mechanisms, as well as of the gear combinations obtainable, are mounted on the machine.

The capacity of the work-spindle has been increased to permit handling work up to 3/8 inch in diameter, which is 20 per cent

greater than formerly. With a larger sized feed-tube, light work up to 1/2 inch in diameter can be accommodated. This applies to parts not requiring heavy operations, which can be produced at full machine capacity from free-cutting materials, such as aluminum, brass, compositions, celluloid, etc.

A few of the structural changes include an improved construction of the spindle and its parts; thorough guarding of the sides and inside ends of the cross-slides; automatic oiling of the cross-slide ways; improvement in the guards that protect the turret indexing and locking mechanism; the provision of stopping plungers in the turret-indexing mechanism, and in the chuck and the feeding mechanisms; and the use of drop-forgings for all trip-levers, lead levers, cross-slide levers, chuck and clutch forks, etc.

The new OOG machine is also available in simplified form for work that does not require all of the functions of the full-auto-

SHOP EQUIPMENT SECTION

matic. There is a turret forming machine for production work that does not require reversal of the spindle, and a cutting-off machine for parts that require neither a reversible spindle nor an indexing turret.

Combination Surface and Needle Pyrometers

A set of combination surface and needle pyrometers adapted for use in the die-casting, plastic molding, rubber processing, paper, textile, electrical, metallurgical, and various other industries has been brought out by the Pyrometer Instrument Co., 103 Lafayette St., New York City.

By merely interchanging the various types of thermo-couples, which requires only a few seconds, the instrument can be transformed into any one of four different types of surface and needle pyrometers. The new indicator is equipped with a "Pyro" patented clamping device, by means of which the temperature readings need not be made while the pyrometer is being held in contact with the part tested, as the indicating needle will stay fixed at the correct graduation.

Natco High-Production Equipment for the Automotive Industry

Five high-production machines equipped with Holeunit individually motor-driven hydraulic heads have recently been built by the National Automatic Tool Co., Richmond, Ind., for specific operations in automobile plants. In Fig. 1 is shown a four-way machine equipped for drilling, reaming, boring, and facing various angular holes in a small four-cylinder engine block. The machine is built up of four Holeunits which contain a total of eight spindles. The production rate is approximately twelve cylinder blocks an hour.

The one-way two-unit combination drilling and tapping machine shown in Fig. 2 comprises a Holeunit and a reversing motor-driven tapping unit which is mounted on the Holeunit. This machine is intended for performing operations on cast-iron rear-bearing retainers. All together, there are twenty roller-bearing drill spindles and seven tapping spindles equipped with lead-screws, a lead-screw plate, and tap-holders.

The machine is provided with an eight-position trunnion type

fixture which holds two rear-bearing retainers in each position. Operations are performed at all eight stations, including the loading station. The production of this machine ranges from seventy to seventy-five rear-bearing retainers an hour.

The new machines also include a six-way drilling machine equipped with five horizontal units and one vertical unit. This machine was built for drilling, counterboring, and reaming operations on forged-steel crankshafts. There are a total of nineteen spindles. The production rate of this machine is approximately fifteen crankshafts an hour.

Another new machine of the two-way angular type is built for drilling seventeen holes in a low-priced six-cylinder engine block at a production rate of about seventy-five blocks an hour. Twelve holes, of 3/16 inch diameter, are drilled by an upper head that is positioned angularly, and the remaining holes, also of 3/16 inch diameter, by a lower head that is mounted on another angular slide.

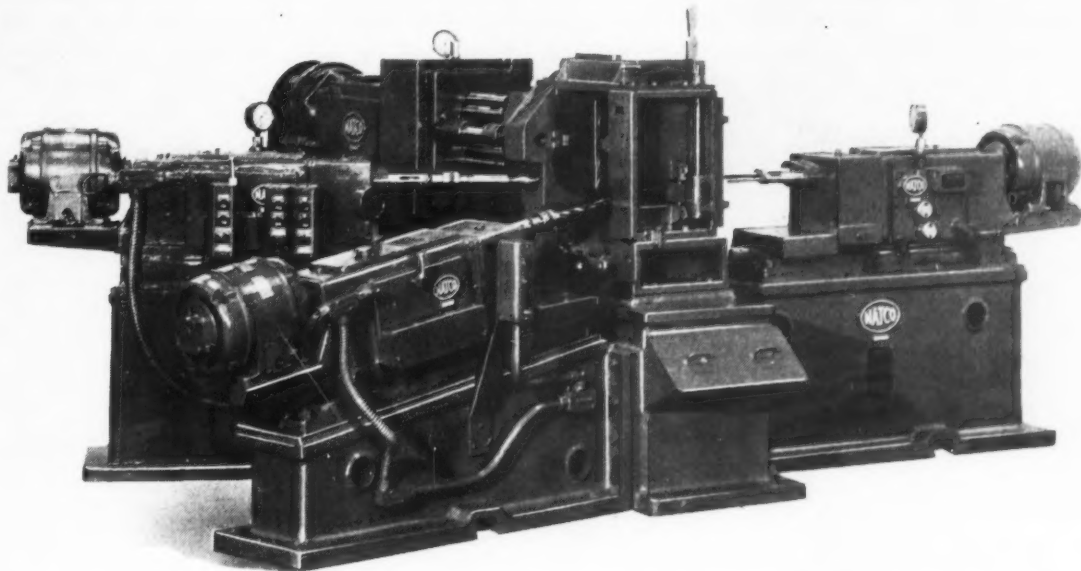


Fig. 1. Natco Four-way Hydraulic Machine Designed for Drilling, Reaming, Boring, and Facing Operations on Cylinder Blocks

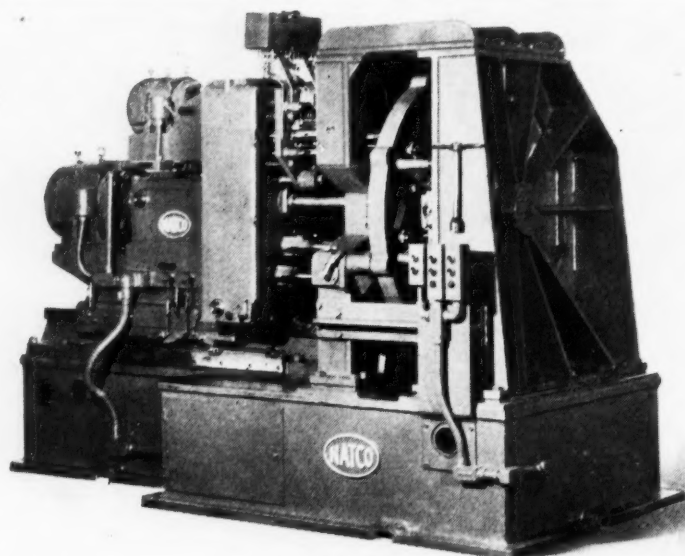


Fig. 2. Natco Machine Built for Drilling and Tapping Rear-bearing Retainers

The fifth machine is of the three-way horizontal type. It is intended for drilling a total of sixty-one holes in the top, bot-

tom, and front end of cylinder blocks at a production rate of from twenty to twenty-two blocks an hour.

Crankshaft Drilling, Milling, Countersinking, Reaming, and Tapping Machine

An automatic hydraulically operated machine of horizontal design was recently built by the Rockford Drilling Machine Co., 310 Catherine St., Rockford, Ill., for performing a series of operations on the flange of large crankshafts. As seen in Fig. 1, this machine is equipped with a five-station work fixture. At the first station of the machine the crankshafts are loaded and unloaded; at the second station six holes are drilled and the center of the flange is milled out; at the third station two locating holes are drilled; at the fourth station the two locating holes are reamed and six holes are countersunk; and at the fifth station six holes are tapped. One of the machined crankshafts is shown in Fig. 2, together with the twenty-three tools which operate simultaneously in performing the various operations.

A patented feature of this machine is the use of a hydraulic circuit for the tapping opera-

tion. All of the tools are mounted on the traveling head, which is located on the right-hand end of the bed. This head passes through an automatic hydraulic cycle consisting of a rapid approach, feed, dwell for obtaining

a fine finish in milling and countersinking, rapid return, and stop. Easily adjusted dogs on the lower edge of the traveling head govern its operating cycle. A manual control for use in setting up the machine is provided through a lever.

Complete control of the machine is provided through a central push-button station which enables the operator to stop it instantly at any point in its cycle. If the machine should be stopped for any reason, the taps will automatically rotate correctly when the machine is restarted. The head is provided with a main driving motor and a second motor which drives the tapping spindles independently. The second motor is reversed automatically upon completion of the tapping operation for rapidly returning the taps to their starting position. This arrangement avoids the necessity of reversing the main driving motor, thus protecting it against excessive overloads. Also, with this arrangement, the drills, milling cutters, and countersinks do not rotate backward across finished surfaces.

On the front of the traveling head is a detachable plate which contains twenty-three spindles, arranged in four clusters. This construction makes it possible to adapt the machine to engineering changes in the work or for use on other kinds of work

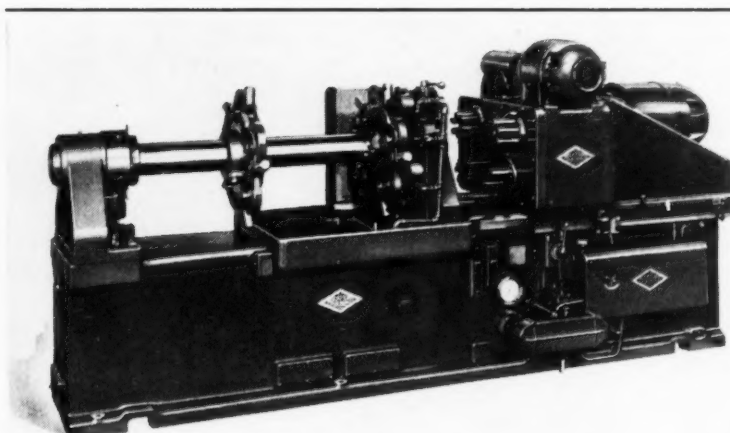


Fig. 1. Hydraulically Operated Machine Built by the Rockford Drilling Machine Co. for Performing a Variety of Operations on Crankshafts

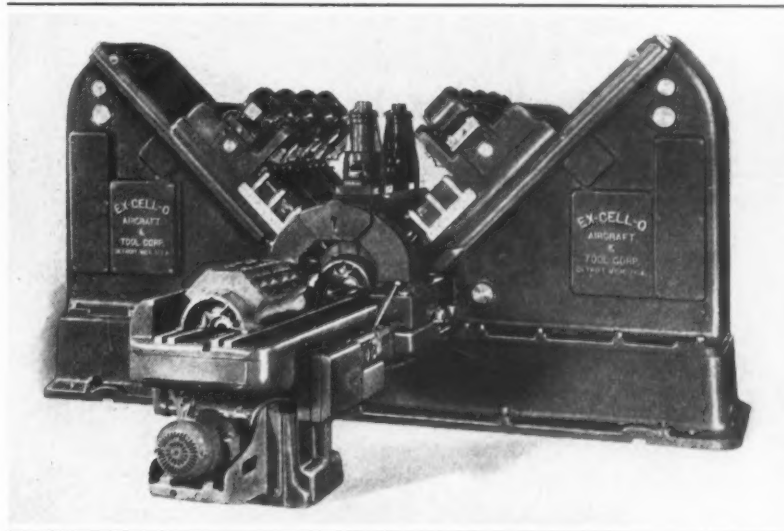
SHOP EQUIPMENT SECTION

by merely changing the spindle arrangement, tooling, and work-holding devices.

The five-station fixture consists of two work-holding heads, mounted on a central shaft that rotates in anti-friction bearings for easy indexing. These bearings are mounted in two heavy supports that are accurately aligned and secured to the machine bed. One of the work-holding heads can be adjusted along the central shaft to accommodate work pieces of different lengths. An integral gage in the fixture facilitates accurate location of the work. Manual indexing of the fixture is facilitated by an electrically operated locating plunger. A mechanically operated guide bar locks the fixture in position during the machining of the work.

Coolant is automatically supplied as the machine starts, and is shut off when the machine is stopped. The simultaneous machining of four work pieces, together with the automatic machine cycle, enables a high production to be obtained that is limited only by the longest operation. This consists of drilling 37/64-inch holes to a depth of 1 9/16 inches.

The features embodied in this machine can also be provided in other Rockford machines of horizontal, vertical, and way types for performing operations on a wide variety of work.



Ex-Cell-O Machine for the Single-point Precision Boring of V-eight Cylinder Blocks

Ex-Cell-O Cylinder-Block Precision Boring Machine

The latest development of the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., in the field of precision boring is the eight-unit machine here illustrated, which is designed for simultaneously boring four alternate cylinders in two engine blocks of the eight-cylinder vee type. Single-point tools, tipped with tungsten carbide, are employed. The work fixture indexes automatically between the machine cycles to bring the cylinder block to the second station. Thus one cyl-

inder block is completed with each cycle of the machine.

The advantage claimed for this machine is that cylinder bores are finished to such close tolerances as to eliminate reaming and to reduce the amount of stock that must be removed in honing. According to the manufacturer, only from 0.0005 to 0.0007 inch of stock need be left in the bores for removal by honing. It is mentioned that the cylinder bores can be held to a tolerance of 0.0003 inch for out-of-roundness and diameter, and within 0.001 inch of parallelism for their entire length. From 0.012 to 0.015 inch of stock is generally removed in the precision boring operation. At the end of each machine cycle, the work fixture automatically recedes 1/32 inch so that the tools are withdrawn without scoring the finished bores.

The spindle slides are hydraulically operated at feeds ranging from 3/8 inch to 12 inches a minute and at a rapid traverse of 11 feet a minute. The spindles are of the sleeve projection type, and run in four Ex-Cell-O precision bearings. Each spindle is driven by an individual motor through two V-belts. The spindle slides can be reversed at any time.

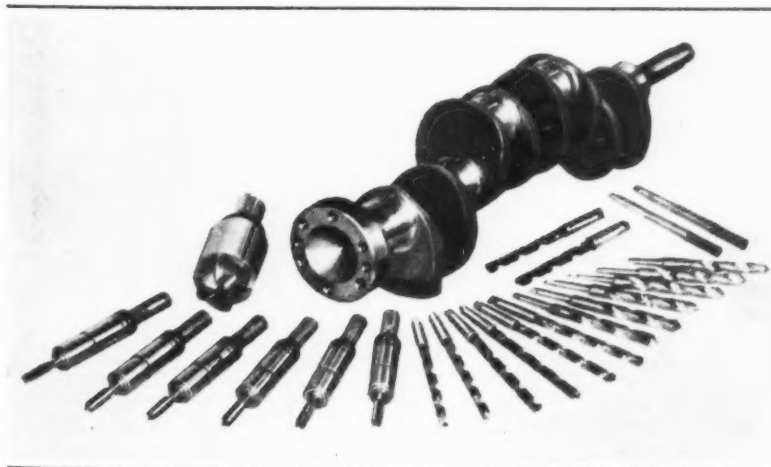
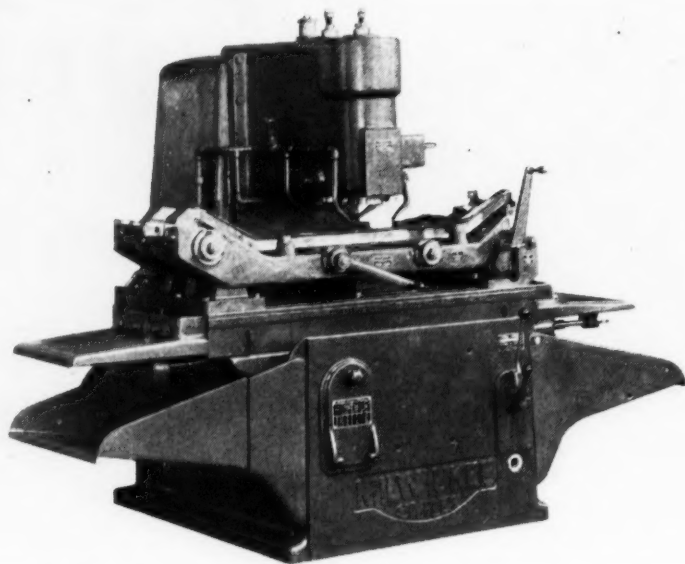


Fig. 2. One of the Crankshafts Machined by the Equipment in Fig. 1, together with the Twenty-three Tools Used for Drilling, Milling, Countersinking, Reaming and Tapping Operations

SHOP EQUIPMENT SECTION



Milwaukee Simplex Machine Equipped for Milling Spring Pads on Two Front Axles Simultaneously

Milwaukee Simplex Milling Machine Equipped for Milling Front Axles

A Milwaukee bed type milling machine equipped for milling the spring pads on two front axles simultaneously has been brought out by the Kearney & Trecker Corporation, Milwaukee, Wis. The two axles are mounted parallel on a hinged fixture designed to facilitate loading the work under the cutters. Quick-acting equalizing clamps are used in conjunction with hand-operated toggles to bring the work into the milling position.

Both spindles in the special two-spindle vertical head are mounted in anti-friction bearings in separate quills. This permits individual adjustment of

the cutters to compensate for wear. The drive to the spindle is obtained through large-diameter gears.

The machine is arranged for full-automatic two-way cycle operation and has hydraulically actuated clutches that permit smooth engagement of the feed or power traverse. The feed to the table is through a large-diameter screw and nut. Coolant is directed on each cutter from two sides. A gusher type pump, mounted externally on the bed of the machine, provides an ample volume of coolant at low pressure. The reservoir for the coolant is built into the base.

Cleereman Sliding-Head Drilling Machines

An improved line of all-gear, anti-friction bearing, automatically oiled, sliding-head drilling machines has been added to the products of the Cleereman Machine Tool Co., Green Bay, Wis. These machines are being placed on the market through the Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill. They are pro-

vided with nine feeds, ranging from 0.005 to 0.045 inch, and with twelve spindle speeds which are available in two ranges of from 50 to 1000 revolutions per minute and from 75 to 1500 revolutions per minute.

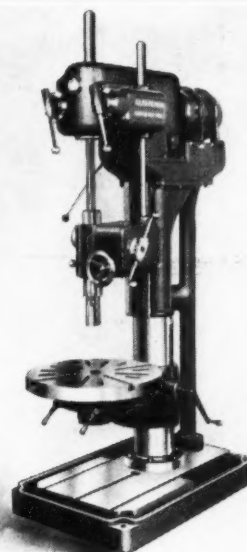
These machines are of the round-column type and are built in sizes of 21, 25, and 30 inches. In addition to the standard model

illustrated, the machines can be supplied in gangs of from two to six spindles. Single-purpose tooling can be furnished to suit individual requirements.

The feed- and speed-boxes are built on the unit principle. They house all gears and the shifting mechanisms. There is only one lever for each unit, which makes it possible to change directly from one speed or feed to another. All shafts in the speed-box are horizontal. Spiral bevel gears drive the spindle, and the spindle unit is completely equipped with ball bearings to take both radial and thrust loads.

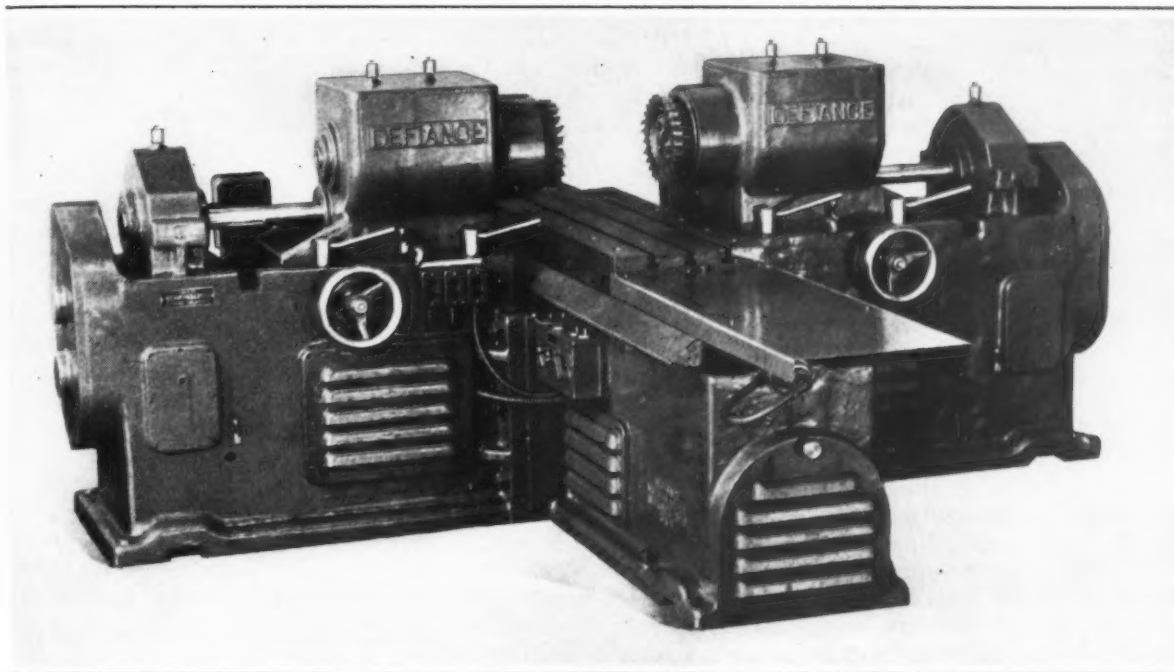
All gears and bearings in the speed- and feed-boxes are automatically oiled by a pressure system. The sliding head is lubricated by an oil reservoir and the worm in this head is submerged in oil.

Friction devices or clutches are not used in these machines for controlling the starting, stopping, and reversing of the spindle, the machine being driven by a standard ball-bearing reversing motor which runs at speeds of from 1200 to 1800 revolutions per minute. This motor is operated by built-in push-button controls. It is direct-connected to the machine. Tapping can be done rapidly with this machine.



Cleereman Drilling Machine with Reversing Motor Drive

SHOP EQUIPMENT SECTION



Defiance Production Type Horizontal Milling Machine with Hydraulic Feed

Defiance Two-Way Face-Milling Machine

A production type opposed-head horizontal milling machine equipped with a hydraulic feed has been brought out by the Defiance Machine Works, Defiance, Ohio. This machine is built for simultaneously face-milling the opposite sides of castings, such as compressor housings, engine frames, cylinder heads, etc. The base of the machine is heavily constructed and is made in three sections. The center section carries the table on dovetailed ways, while the end sections have dovetailed ways on which the opposed heads are mounted.

The hydraulic table feed provides an automatic cycle of fast advance, feed, rapid return, and stop. By providing additional dogs, the cycle can be arranged to give a fast advance, feed, skip, feed, and rapid return. The table can be fed in either direction by simply adjusting the control dogs.

The working surface of the table is 18 inches wide by 36 inches long. The length of travel is 48 inches. The control can be adjusted to give feeds ranging from 1 1/2 to 40 inches per min-

ute. The fast travel is at the rate of 240 inches per minute. The maximum distance between the spindle noses is 21 inches, and the minimum distance 11 inches.

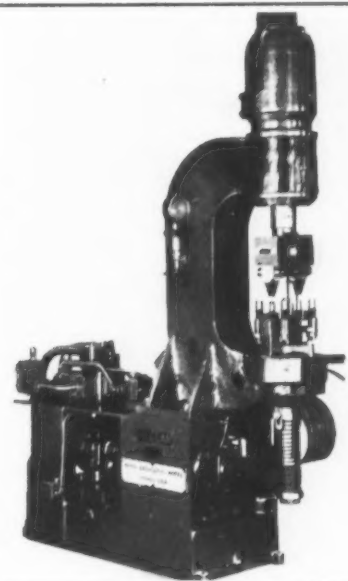
The cutter-spindles run in Timken bearings. Changes in spindle speeds are obtained by means of pick-off gears. The illustration shows the machine equipped with 10 1/2-inch face-milling cutters which are run at a speed of 42 revolutions per minute. Face-milling cutters up to 12 inches in diameter can be used. The spindles can be revolved in either direction by reversing the motors. The heads are arranged for V-belt drives.

Hanna Motor-Driven Hydraulic Riveter

A self-contained riveting machine that provides unusual flexibility as to speed-and-load ratio is a recent development of the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. This machine is designed to take peak loads smoothly without damage to the mechanism. It is equipped with an Oilgear fluid power

pump which is direct driven by an electric motor through a flexible coupling. The pump, motor, valves, and circuit parts are mounted on a rigid combination base and oil reservoir.

Initial work or closing movements are performed at a high speed and low pressure. Maximum pressures can be regulated



Hanna Self-contained Hydraulic Riveter

to suit the work, thus holding the power consumption to a minimum and avoiding distortion of the work by the application of excessive force. At the maximum pressure of 3000 pounds per square inch, the riveter illus-

trated exerts a pressure of 80 tons on the dies.

Machines of this type are also available in capacities of 20, 40, and 60 tons. The reach and gap can be varied to suit the work to be performed.

Oliver Universal Cutter-Grinder

A universal tool- and cutter-grinder of the style here illustrated is being introduced on the market by the Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich. This machine differs from the standard type in that it is not adapted for cylindrical, internal or surface grinding. By eliminating such provisions, it is claimed that the machine has been adapted for grinding the general run of cutters and reamers more rapidly and accurately.

One of the important features is a universal fixture, adjustable in all directions, which is arranged to receive a few simple tool-holding devices. The grinding wheel is reciprocated by

means of a ram, on which the wheel is mounted at the front and driven through a belt by a motor at the back. The ram, spindle, and motor are all located above the grinding wheel, away from the flow of emery. In addition, they are carefully protected from dust and dirt.

In grinding a cutter, the work is always within convenient view of the operator. Hence it is not necessary for him to stoop or sit in order to observe the operation or run the machine. The lip rests provided are designed to handle any cutter. Clearance is obtained by tilting the grinding wheel to the desired angle, as indicated by a direct reading, no computa-

tions being necessary. Cutter teeth can be backed off without changing the setting of the work.

Angular cutters, dovetail cutters, and end-mills are easily handled. Fig. 2 shows a helical milling cutter being ground. The wheel-spindle is held in one position in this operation, while the cutter is moved back and forth beneath it on an arbor. There is a fixed lip rest beneath the wheel, which has a cross adjustment, so that after sharpening the cutter, a secondary clearance can be ground by rolling the cutter forward slightly without losing the original setting of the lip rest.

Harnischfeger Welder of Greater Amperage

The Harnischfeger Corporation, 4536 W. National Ave., Milwaukee, Wis., is now introducing on the market a 75-ampere vertical welder of the same appearance as the 50-ampere welder described in April, 1935.

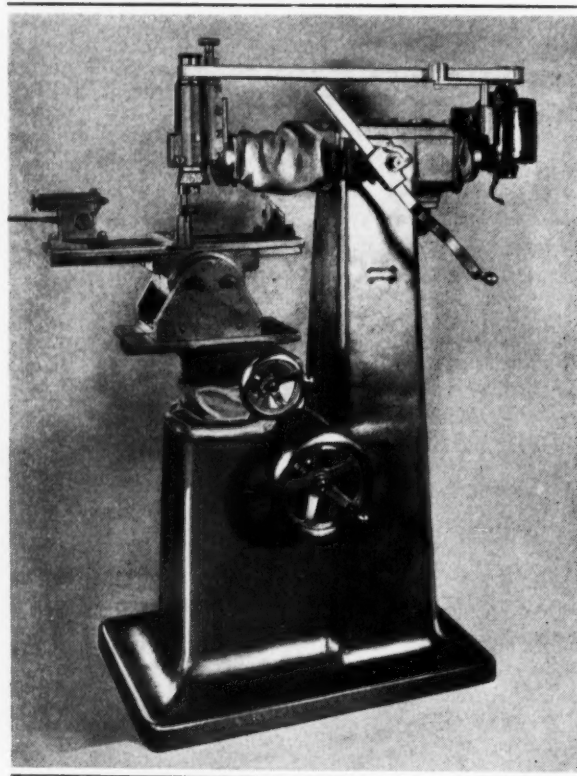


Fig. 1. Oliver Tool- and Cutter-grinder with Reciprocating Ram for the Grinding Wheel

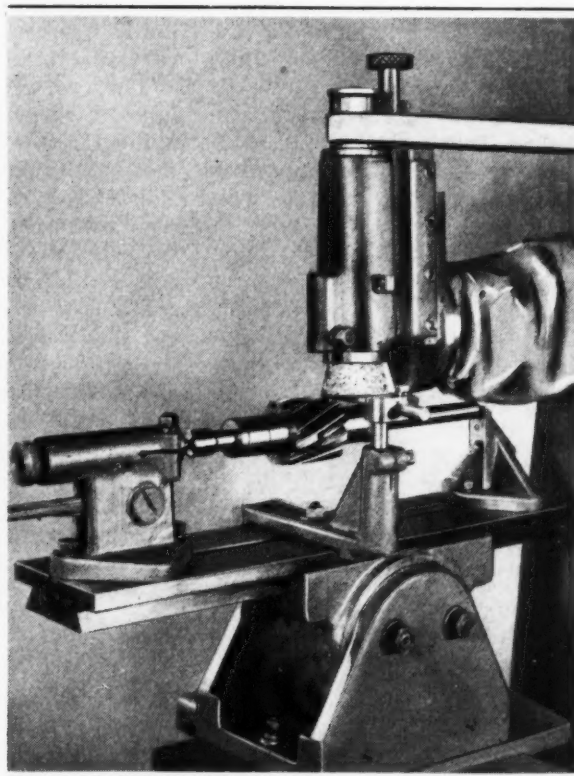


Fig. 2. Grinding a Helical Milling Cutter by Holding the Wheel in One Position and Moving the Cutter

SHOP EQUIPMENT SECTION

MACHINERY, page 520-D. An important feature of the new welder is an unusually stable high-speed arc.

Mounted on top of the generator is a heavy-duty five-horsepower squirrel-cage motor of drip-proof construction. This motor is fan-cooled; it is operated by push-buttons, and is equipped with a no-voltage release and overload protection. Connections are available for 110- to 550-volt current or for

special voltages of two or three phase, and 60 or 50 cycles. A single control is provided for current settings over the entire welding range, so as to reduce dependence upon the human element.

This unit is capable of handling work as light as No. 24 gage, and is thus adapted to the requirements in manufacturing metal furniture, furnaces, kitchen utensils, steel sash, containers, and similar products.

Baldwin-Southwark "Hyspeed" and General Utility Presses

A 500-ton "Hyspeed" hydraulic press which can be operated at a speed of fifteen strokes per minute has been built by the Baldwin-Southwark Corporation, Philadelphia, Pa. This machine (Fig. 1) is especially suited for pressing parts from hot steel. It can also be used for forging, forming, and similar operations.

The motor-driven rotary piston pump and the necessary oil tanks are mounted on the top platen, making the press entirely self-contained. The stroke of the moving platen can be adjusted and set to any predetermined distance within its range. It can also be set to stop and return the platen automatically

when a specified pressure has been obtained under the die, or when a predetermined height above the bottom die has been reached. A manually operated valve control on the pull-back cylinders permits sensitive regulation of the platen movement in setting up the dies.

A 75-ton "moving down" type of press, shown in Fig. 2, is another recent development of the concern. This press is designed to perform a variety of operations in both large and small shops, including the forcing in or out of bushings, bending, straightening, and pressing and forming of small parts. The press is also adapted for use in experimental work, such as making briquettes and recovering liquids from various materials.

A single valve lever starts and stops the machine, holds the ram in any desired position, and regulates the speed. The ram is double-acting, eliminating the necessity for pull-back or auxil-

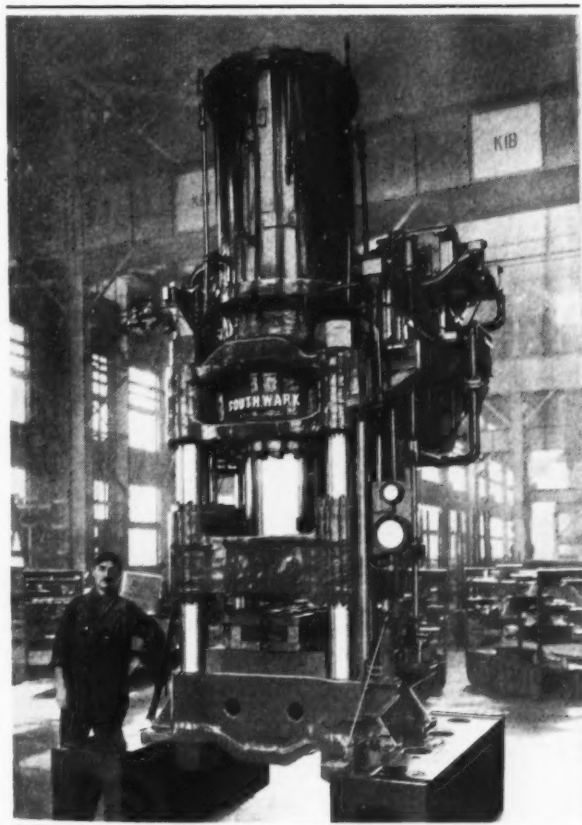


Fig. 1. Baldwin-Southwark 500-ton "Hyspeed" Hydraulic Press

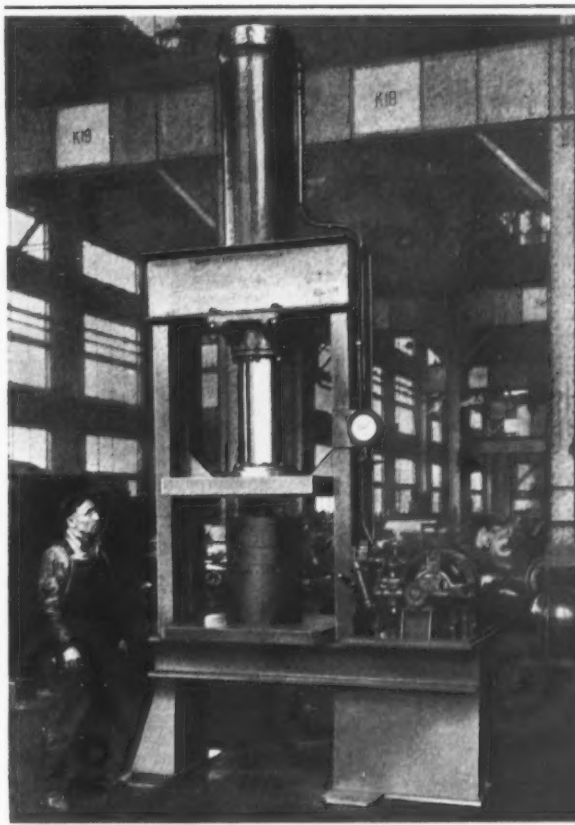


Fig. 2. Baldwin-Southwark General Utility 75-ton Hydraulic Press

iary cylinders for returning the main ram to its starting point. Pressure is furnished by a rotary motor-driven hydraulic pump.

"Multiplex" Wire-Forming Machine

An automatic wire-forming machine known as the "Multiplex," which has a capacity for forming wire parts up to No. 10 gage by 21 inches in length has been developed by the Economy Tool & Machine Co., 10 W. Delano St., Muskegon Heights, Mich. The wire is fed into the machine from a reel, automatically straightened, cut to the desired length, and formed by dies to exact specifications.

The length of the wire formed can be varied while the machine is in operation. Less than five minutes is required for changing dies and adjusting the machine. Forming dies made to suit specifications can be furnished for the machine, making it a com-



"Multiplex" Wire-forming Machine

plete unit, ready to operate. The production rate is 100, 125, or 150 formed wires per minute. A one-horsepower geared motor on an adjustable base provides three speeds through a V-belt.

turning, facing, and boring tools. Diamond wheels, silicon-carbide vitrified cup-wheels, or diamond lapping disks can be used.

Three different methods of grinding can be employed: Roughing and finishing cuts can be taken, using two silicon-carbide cup-wheels; a roughing cut can be taken with a silicon-carbide cup-wheel, followed by a finishing cut with a diamond wheel; or a roughing cut can be taken with a silicon-carbide vitrified cup-wheel, followed by lapping with a diamond lapping disk. Tools with shanks up to 5/8 inch square can be rough-and finish-ground with silicon-carbide vitrified wheels. Larger size tools can be handled when grinding with diamond wheels or when using the lapping disk.

The grinder is driven by a V-belt from an electric motor in the machine base. The tool supports at each end of the machine have hardened and ground surfaces. Each table has a graduated scale for angular adjustments up to 16 degrees above or below center, and a 2-inch adjustment for wheel wear. The protractor tool-guide is adjustable through a full range of 180 degrees. A gravity-feed coolant reservoir is located in the upper part of the wheel-head. A drum type switch provides means for starting, stopping, and reversing the direction of rotation of the motor for grinding right- and left-hand tools.

The style No. 48 grinder, shown in Fig. 2, is designed for grinding single-point turning, facing and boring tools of high-speed steel and cemented carbide, in the larger sizes. Both peripheral grinding on straight type vitrified wheels and face-grinding on cup type vitrified wheels can be done on this machine. The grinder is of the double-end type, and is also driven by a double V-belt from an electric motor located in the base. As this machine is designed for dry grinding, a dust exhaust opening is cast at each end of the base below the grinding wheels. The electrical control and the table construction are similar to those of the style No. 46 machine.

Ex-Cell-O Cemented-Carbide Tool Grinders

Two new models have been added to the line of cemented-carbide tool grinding machines made by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oak-

man Blvd., Detroit, Mich. The style No. 46 grinder, shown in Fig. 1, is designed for the rapid grinding and lapping of single-point, cemented-carbide-tipped

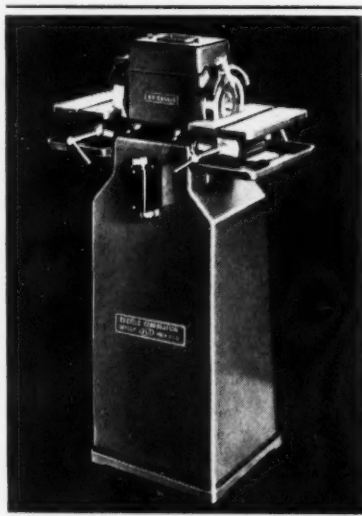


Fig. 1. Ex-Cell-O No. 46 Grinder for Cemented-carbide Tools



Fig. 2. Ex-Cell-O No. 48 Grinder for the Larger-sized Tools

SHOP EQUIPMENT SECTION

Electric Welding Machines for Assembling Oil Filters

Two special welding machines for use in assembling automotive oil filters have been developed by the National Electric Welding Machines Co., 1846-60 N. Trumbull St., Bay City, Mich. The machine in Fig. 1 projection-welds two plugs simultaneously in one end of the filter. These plugs are threaded on the inside to receive the oil-line fittings. After this operation, the lower die and electrode are rotated on a movable table, and a single plug is welded into the other half of the oil filter.

The machine is motor-driven; the operator merely loads the work and turns it into place, where it is automatically locked in the proper position for welding. The table is unlocked by means of a foot-pedal and turned 180 degrees for the next weld. These two movements—the turning of the table and the operation of the foot-pedal lock—are the only manually controlled movements.

The other machine, shown in Fig. 2, welds together the two cup-shaped halves after the plugs have been welded on the

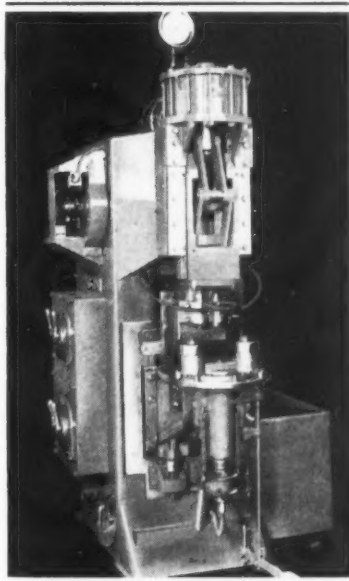


Fig. 1. Machine for Welding Plugs in Oil Filters

machine shown in Fig. 1 and the filter packing has been inserted.

With the rolls operating continuously, the work fixture is turned until it locks into position for welding. This opens an air valve which brings the head down, and when sufficient welding pressure is built up, a switch operates a timer, which closes the welding circuit until the oil filter makes a complete revolution in the holder. A slight overlap insures welding of the entire flange. The timer then breaks the welding circuit and raises the head. The fixture with another assembly is then rotated to the welding position and the welding cycle started automatically. The two-station fixture enables work to be reloaded during a welding operation.

These welding machines save a number of operations and about 400 pounds of solder a day. Also, a much better looking job is obtained. The production rate of the two machines is over 400 completed units an hour.

Cataract Precision Ball-Bearing Bench Lathes

Headstocks with preloaded ball bearings designed for high spindle speeds and unusual accuracy are a feature of precision

bench lathes recently brought out by Hardinge Bros., Inc., Elmira, N. Y., for tool-room, laboratory, and production work.

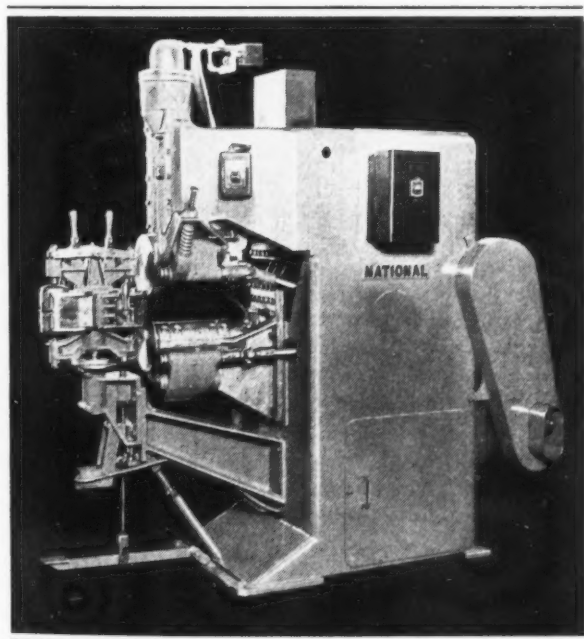


Fig. 2. Seam Welding Machine for Assembling Parts Welded on the Machine Shown in Fig. 1

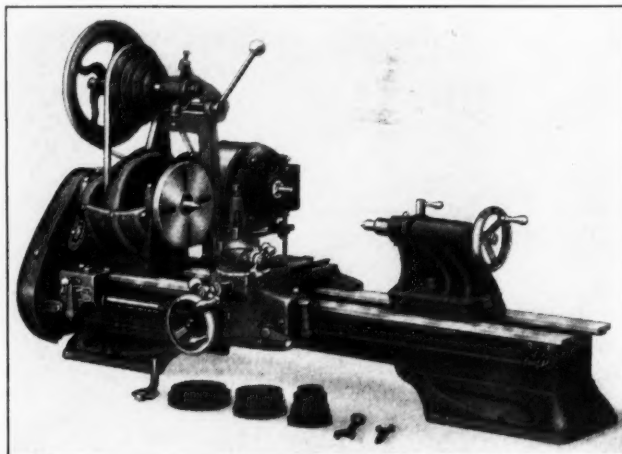


Cataract Bench Lathe with Ball-bearing Headstock Designed for High Spindle Speeds

In general appearance, these machines resemble the sleeve-bearing type lathes described in August, 1934, *MACHINERY*. One unit of the line has a range of six spindle speeds forward and six reverse speeds ranging from 230 to 2500 revolutions per minute. Another unit has eight forward speeds and eight reverse speeds from 230 to 3900 revolutions per minute.

A mechanical brake in the headstock, operated by the control lever, permits stopping the spindle quickly. The brake-band is arranged around the spindle pulley, and the lining is not riveted to it, but is allowed to float or rotate when the brake is applied, thereby presenting ever changing surfaces to more evenly distribute the wear.

The five sizes of these lathes available cover a range of collet capacities from 1/2 to 1 inch.



Atlas "Streamline" Metal-cutting Lathe

Atlas Metal-Cutting Lathes

A new line of Atlas metal-cutting lathes of "streamline" design with improved mechanical

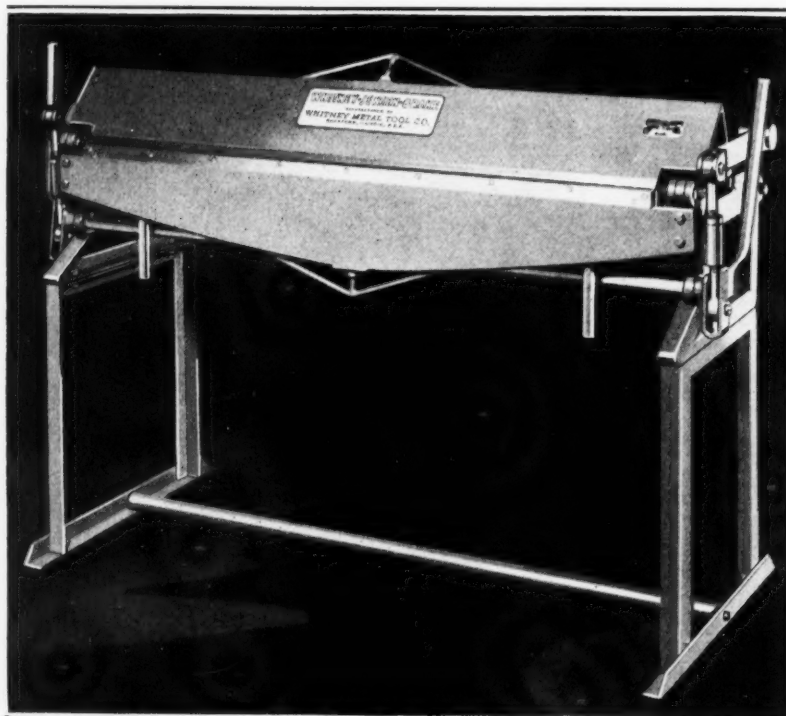
features has been brought out by the Atlas Press Co., 353 N. Pitcher St., Kalamazoo, Mich., to meet the demand for more accurate and more easily operated lathes within the low-price range. The illustration shows a 36-inch back-gear screw cutting lathe of this line with a self-contained countershaft and universal motor bracket. This lathe has a threading range from 4 to 96 threads

per inch and sixteen speeds. An enclosed on-and-off switch, automatic reversible power feeds, a threading dial, a graduated tailstock ram and a V-belt drive are standard features.

Whitney Light-Weight Bending Brake

A light bending brake weighing only 265 pounds, which can be carried from job to job, has

been brought out by the Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill. This bending brake is to be known as the "Air Condition Special" because it has a capacity for bending 20-gage commercial sheet iron, such as is used in air-conditioning work. It is 4 feet 1 inch in length and can be supplied in either floor or bench types. A smaller size is also available.



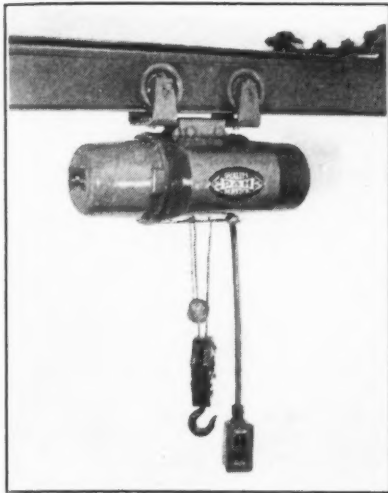
Whitney Floor Type Bending Brake Designed Primarily for Use in Fabricating Air-conditioning Equipment

Harnischfeger "Zip-Lift" Hoist

A line of light electric hoists known as "Zip-Lifts," with capacity ratings of from 250 to 500 pounds, has been brought out by the Harnischfeger Corporation, 4536 W. National Ave., Milwaukee, Wis. These hoists are designed primarily for "spot handling" work in machine shops, welding shops, storage booths, foundries, etc. The units are of all-welded construction and are exceptionally light, the quarter-ton model weighing only 100 pounds.

The ball-bearing motors used

SHOP EQUIPMENT SECTION



Light Electric Hoist Made by Harnischfeger Corporation

are especially designed for hoisting service, giving smooth operation through a simplified planetary gear train, which is fully enclosed and runs in oil. The hoisting speeds range up to 32 feet per minute and are controlled either by a push-button or pendent rope.

To simplify installation, all complicated wiring has been eliminated, so that for hook, trolley, or jib crane service, the hoist need only be connected with the source of electric current. Safety is assured by a weight type limit switch, solenoid dry disk motor brake, and a ratchet and roller type mechanical brake. Standard units are furnished with or without a trolley.

Walser Motor-Operated Timer

A motor-driven timer designed for use on machines or in connection with industrial processes whenever an operation is to be performed within fixed intervals of time for ex-

tended periods has been added to the products of the Walser Automatic Timer Co., Graybar Bldg., New York City. Typical applications include the control of various types of machinery with fixed operating cycles, automatic oiling systems, steel mill equipment, and ventilating systems.

The new unit, which is known as Jewel No. 11, can be adapted to any time cycle of seconds, minutes, or hours. Two or more adjustable cams mounted on a drum are rotated by the self-starting motor through reduction gears to obtain the cycle required. The entire unit is enclosed in a metal housing from which it can be easily removed when required.

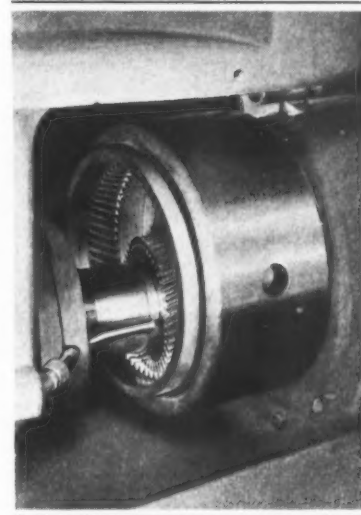


Fig. 2. Crowning Internal Gear Teeth

Machine for Crowning Internal Gear Teeth

An automatic gear-tooth shaving machine designed to crown the teeth of internal gears so that the chordal thickness of the

teeth at the ends is slightly thinner than at the center has been developed by the National Broach & Machine Co., Shoemaker and St. Jean,

Detroit, Mich. This machine is intended primarily for use in finishing the teeth of gears used in internal gear drives for motor cars. When such gears are in continuous mesh and run at high speeds, it is important that the teeth have a crowned surface, so that the small planet gears will not bear heavily at their edges under varying torque. The machine can be adjusted to crown the teeth the amount required to offset any misalignment of the shafts.

The patented crossed-axes shaving method is used in this machine. In the case illustrated, the chordal thickness of the teeth at the ends varies from that at the middle by 0.001 inch. The production is 30 an hour, and the finish is such that no burnishing is required.



Fig. 1. Internal Gear Tooth Crowning Machine Developed by the National Broach & Machine Co.

Improved Oilgear Variable-Speed Transmissions

The line of fluid-power variable-speed transmissions built by the Oilgear Co., 1310 W. Bruce St., Milwaukee, Wis., has been greatly simplified and improved by redesigning the input and output units. The elimination of thirteen parts from each piston has made possible higher speeds, longer life, and lower cost of operation. The improved line is made in six types, two of which are shown in Figs. 1 and 2.

The new pistons, shown at A, Fig. 3, are used in both the input and output units which form

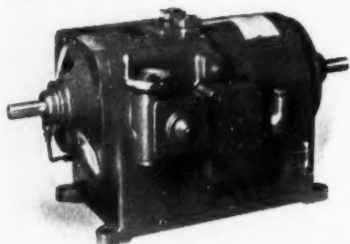


Fig. 1. Oilgear Type DFC Variable-speed Transmission

the left- and right-hand ends of the transmission. The control wheel B at the top of the input end is connected to a slide block C, mounted between four horizontal ways. This block carries the complete rotor unit and permits varying the stroke of the pump unit by means of the control wheel B. This development enables the capacities to be increased, and at the same time, permits a reduction in the size and cost of the unit. Also, the friction and resistance load on each piston is less.

The output speed of these transmissions can be adjusted smoothly from 5 to 1090 revolutions per minute. The transmissions are available in sizes from 2 to 100 horsepower, and can be controlled either by hand or by automatic direct and remote devices. They are now in use in many plants in the machine, pa-

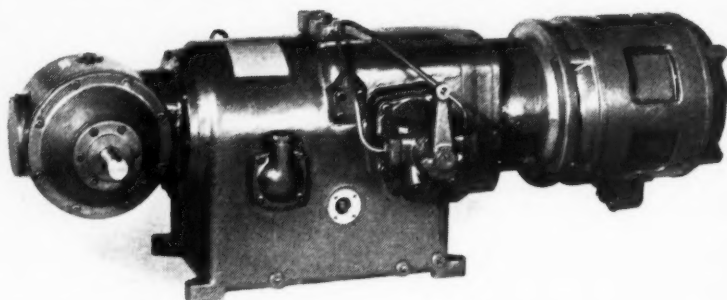


Fig. 2. Type DHC Oilgear Transmission with Motor Drive and Speed Reducer

per, printing, processing, and rubber industries.

The new variable-speed transmissions consist of a volumetric variable-displacement pump which drives a constant-displacement motor. High-grade lubricating oil is used as the power fluid, which flows from unit to unit through drilled and cored passages. Protection against overloading is provided by relief valves in the fluid passages. The principal characteristic of this type of transmission is the smooth speed control obtained, irrespective of the load. An inherent advantage is that the leakage of the high-pressure oil or working fluid between the pistons and cylinders insures forced lubrication to the running parts, giving them long life.

When a very accurate adjustment of the output shaft speed is required, the Type DFC transmission shown in Fig. 1 is especially recommended. This type is furnished with a large worm-wheel on the screw shaft and a handwheel on the worm-shaft for controlling the speed. Approximately 220 to 460 revolutions of the handwheel are required to vary the output speed from zero to maximum in either direction, depending on the size of the unit.

With the hydraulic "Servomotor" lever control, Type DHC transmission, shown in Fig. 2, a small lever provides instant and smooth variation of the output shaft speed in either direction from zero to maximum. A movement of the control lever through an angle of 50 degrees to either

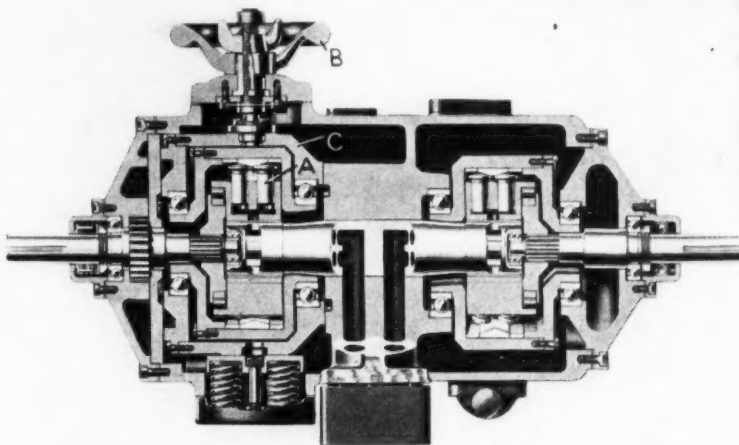


Fig. 3. Plan View Section of Oilgear Transmission with Improved Piston Design

SHOP EQUIPMENT SECTION

side of the neutral by-pass or idle position increases the output shaft speed automatically in proportion to the movement of the control lever. The control lever can be mounted 90 degrees or 180 degrees from the position shown, and on either side of the unit, to facilitate semi- or full-automatic control from a remote part of the machine.

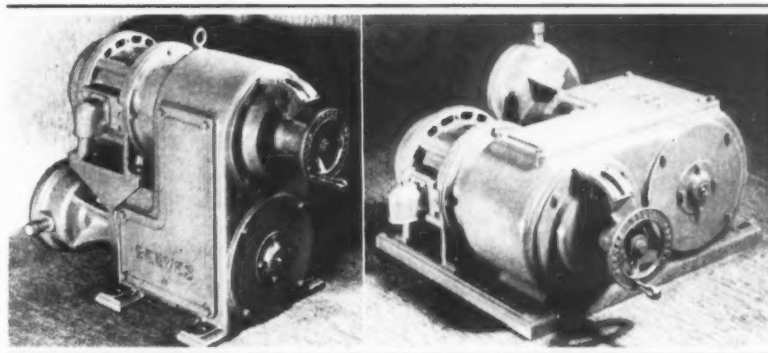
This type of transmission is adapted for driving conveyors, paper processing and printing machines, and machines in manufacturing plants requiring rapid and frequent speed changes. It is suitable for reciprocating large grinding machine tables.

Reeves Self-Contained Vari-Speed "Motodrive"

A variable-speed drive that combines in a compact, self-contained enclosure any standard make of constant-speed motor, a variable-speed control mechanism, and, when required, speed reduction gears has been brought out by the Reeves Pulley Co., Columbus, Ind. This drive is made in vertical and horizontal types, as shown in the illustrations. It is particularly adapted for installation on machine tools and other industrial equipment where space is limited.

Features of both the Reeves variable-speed transmission and the vari-speed motor pulley are combined in this "Motodrive," which consists essentially of a V-belt running between two sets of cone-faced disks which can be adjusted on parallel shafts to change their effective diameters. One shaft receives power at a constant speed from the motor, and the other transmits power at infinitely adjustable speeds to any driven machine. The variable-speed shaft can be extended on either side of the unit.

Both the vertical and horizontal units are built in four sizes which take motors ranging from 1/4 to 7 1/2 horsepower. The speed ratios range from 2 to 1 up to 6 to 1. Reduction gear units of the helical gear type in ratios up to and in-



Vertical and Horizontal Types of Variable-speed Drive Recently Developed by the Reeves Pulley Co.

cluding 189 to 1 may be incorporated in the drive. In different combinations of sizes, ratios, and reduction gears, output speeds ranging from a minimum of 1.35 revolutions per minute to a maximum of 3480 revolutions per minute can be obtained.

Leeds & Northrup Speed Recorders

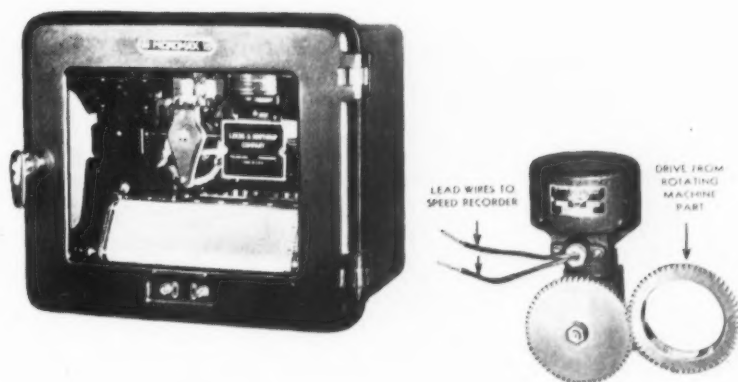
The speed of a rotating member can be continuously indicated and recorded at any desired location, regardless of the distance from the rotating member, by means of a Micromax speed recorder developed by the Leeds & Northrup Co., 4921 Stenton Ave., Philadelphia, Pa. This equipment is entirely automatic in operation and can be easily installed. It is adapted for ap-

plication to presses, paper, rayon, and silk machines, turbines, and other machines.

A heavy-duty tachometer magnet attached to the rotating member generates an electromotive force that is proportional to the speed. The generated current is carried by ordinary lead wires to a Micromax recorder. The recorder immediately indicates the speed for the guidance of the operator, and keeps a continuous record of the speed on a moving chart. The recorder can also be used to actuate signals or any type of warning device.

Alemite Oil-Cups for Machine Lubrication

Two types of sight-feed oil-cups have recently been added to the line of oiling devices made



Micromax Speed-recording Equipment Developed by the Leeds & Northrup Co.

by the Alemite Division of the Stewart-Warner Corporation, 1826 W. Diversey Parkway, Chicago, Ill. One of these oil-cups, known as the "Alemite Thermatic," is designed for use where a constant, slow flow of oil is desired. It requires no attention other than filling, and operates simply by the expansion of air resulting from the normal increase in temperature of a running bearing. A rise of 1.8 degrees F. is sufficient to start a slow flow of oil. An 80-mesh filter screen at the bottom of the reservoir removes any foreign particles that may be in the oil.

The other type of oil-cup, known as the "Microflow," is adapted for use on bearings that require a continuous flow of oil in small, adjustable quantities. It is fitted with a new device that permits a fine adjustment of the oil flow and insures positive operation by preventing clogging. Both types of cups are chromium-plated and harmonize with modern machines.

Underneath Drive for South Bend "Workshop" Lathe

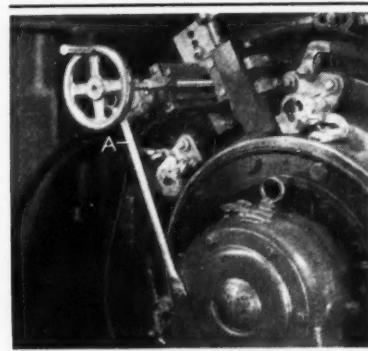
The 1936 model 9-inch "Workshop" lathe made by the South Bend Lathe Works, 721 E. Madison St., South Bend, Ind., which was described in February MACHINERY, page 421, is now available with an underneath belted motor drive. The lathe is mounted on either a frame or a cabinet bench, while the driving unit and motor are supported by a pivoting frame on the under side of the bench. When the tension-release crank-handle seen at the front of the cabinet in the illustration is moved in a semicircle, the entire driving unit is lifted vertically about 2 3/4 inches, so that the spindle belt can be shifted. The

hinged cover which encloses the headstock can be raised to permit shifting the cone pulley.

Supports for Commutator Grinders

Several new types of supports that simplify the use and broaden the application of the commutator and slip-ring grinders made by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., have been added to the line of regular supports furnished with these grinders. The O.E. type support, shown at A in the illustration, is attached to the motor, so that the grinding tool, with its resurfacing element, is mounted on a rigid base in the right position and high enough for non-obstructive and easy operation. As the grinder is mounted on the support between the brush-holders, the resurfacing is done without dismantling the brush-holders, and at the normal operating speed with the motor armature in its own bearings.

There is also a T.O. type support, designed to be attached to the brush yoke and bearing pedestal, and a W type, which is used for mounting Ideal grinders on the larger exciters, motors, and generators. The "Universal"



Commutator Dresser with New Type Support

type is attached to the main housing and bearing support, while the "Plate" type is intended for the smaller units and is attached to the end bell of the motor.

Forbes & Myers Variable-Voltage Transformer for Portable Equipment

Transformers designed for use in demonstrating motor-driven machines or equipment, which must be set up in different exhibiting halls or shops where the current available may be 220, 440, or 550 volts, have been developed by Forbes & Myers, 172 Union St., Worcester, Mass.

These transformers are arranged to take current from lines of any of the voltages mentioned and deliver the voltage required to operate the machines.

This type of transformer is also adapted for use by small companies when moving to a building having current of a different voltage. In such cases, a single transformer will often permit the machines to be operated successfully, thus avoiding the trouble of exchanging or rewinding the motors.

The transformers are of the semi-port-



South Bend "Workshop" Lathe with Underneath Drive

SHOP EQUIPMENT SECTION

able type, and can be handled easily. They can be merely placed on the floor, bolted to the wall, or hung from the ceiling. They are covered by a ventilated steel case, which provides full protection. No oil is used, cool-

ing being accomplished by the natural circulation of air through the ventilating openings. The standard sizes range from 1 to 50 kilovolt-amperes, the largest size being sufficient for an installation totaling 50 horsepower.

Special Work-Holding Fixture for Landis Threading Machine

A work-holding fixture designed to maintain concentricity between both ends of a threaded part has been placed on the market by the Landis Machine Co., Waynesboro, Pa., for use on threading machines built by that concern. The illustration shows this fixture applied to a single-head, motor-driven machine used for threading both ends of a Diesel engine camshaft.

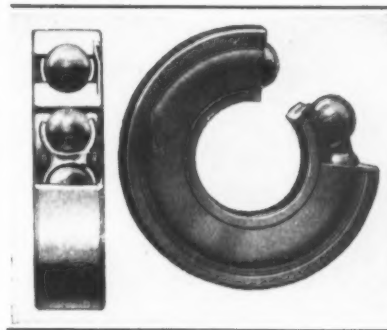
A 7/8-inch hardened and ground Lanco head is used for cutting the threads. In this case, especially close tolerances were specified on the concentricity of the two ends. To insure the required accuracy, the camshaft is held in V-blocks made of hardened steel, which grip the bearing surfaces at each end of the camshaft. There is a self-align-

ing clamp which is shown in the open position.

The fixture is attached to the carriage of the machine, and can be adjusted to obtain the required alignment. The rear locating plate can be adjusted for different lengths of camshafts. The fixture is so designed that it can be easily adapted for holding other types of work requiring the threading of both ends in true alignment.

Fafnir Improved Grease-Shield Ball Bearings

Grease-shield ball bearings of improved construction are now being supplied in a wider range of sizes by the Fafnir Bearing Co., New Britain, Conn. These



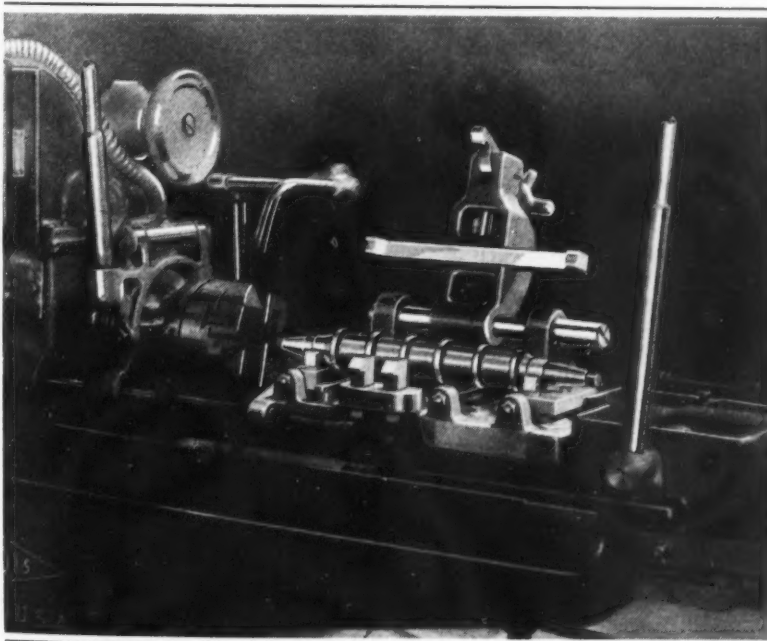
Fafnir Grease-shield Ball Bearing

bearings are equipped with single or double metal side-shields or plate seals to retain the lubricant and to exclude dirt and foreign matter. The self-contained shields simplify the housing design problems in moderate service applications and supplement additional covers, grease baffles, etc., where the service is severe.

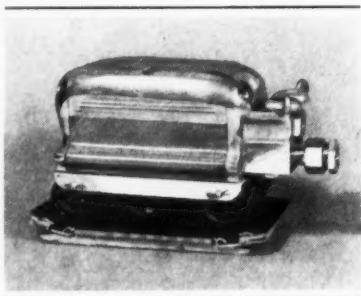
The single-shield D type design consists of a steel stamping fastened to one side of the outer ring of the bearing. This stamping extends into a rabbet on the end of the inner ring with only a few thousandths of an inch clearance. A recent improvement permitted shortening this rabbet, so that less of the inner ring is cut away, thus leaving a larger portion of the face in contact with the shoulder or lock-nut in the mounting. The shield itself does not project beyond the bearing.

Shielded single-row bearings are interchangeable with standard units, as the shield does not increase the bearing width. These bearings are now made in more than fifty sizes with bores from 4 to 110 millimeters and outside diameters from 16 to 225 millimeters. Twenty sizes are also available in bearings of the double-row single-shield variety.

Double-shield DD type bearings, particularly recommended for retaining the lubricant in bearings for longer periods under severe conditions, are also made in a wider range of sizes than previously. Their bores range from 6 to 100 millimeters, and their outside diameters from 19 to 215 millimeters.



Landis Threading Machine Equipped with Special Fixture for Maintaining Concentricity of Threads at Opposite Ends of Work



Sterling "Speed-Bloc" Sander of Improved Design

Sterling Improved "Speed-Bloc" Sander

Several improvements have been made in the "Speed-Bloc" sander manufactured by the Sterling Products Co., Curtis Bldg., Detroit, Mich., that have increased the usefulness of this equipment for both wet and dry sanding operations. It is now applicable to more curved surfaces and to all flat surfaces of metal, fabric, wood, composition, or marble.

The floating principle applied to the block and pad gives a new motion to the abrasive paper. The contact of the abrasive surface has been increased approximately 90 per cent by using tubular rollers of rubber composition between the pad and air motor to replace the former bridge construction.

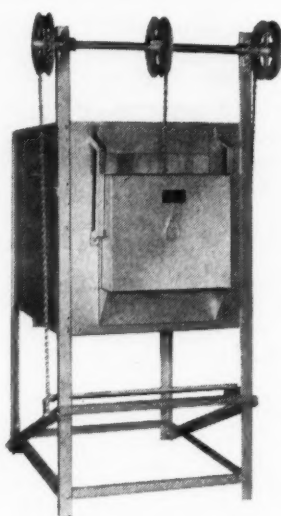
The sanding block is now made in five parts instead of one. A hardened steel shoe which receives the thrust is vulcanized to the rubber block instead of being held by screws. The air motor has been improved to give smoother operation and to decrease air consumption. Full operation is accomplished with an air pressure of 50 to 60 pounds per square inch. The oscillating stroke of the pad is $\frac{5}{8}$ inch, and the speed 3000 strokes per minute.

Trent Electric Furnace

A new development of the "H" line of electric furnaces manufactured by the Harold E. Trent Co., 618-640 N. 54th St., Phila-

delphia, Pa., is being placed on the market. It is rated at 14 kilowatts, 230 volts, single-phase current, and is capable of operating at temperatures up to 1850 degrees F. The inside dimensions are 12 inches wide by 9 inches high by 24 inches deep.

The furnace door is lifted by a chain connected to a foot-treadle. The chain can be locked in any desired position and automatically released to close the door. Special attention has been given to the door structure and its locking arrangement, in order to make the furnace sub-

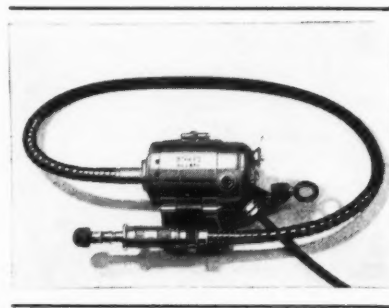


Trent Box Type Furnace with Autotransformer and Magnetic Switch

stantially air- and heat-tight without the necessity of using a sand seal. The "folded and formed" heating element used on all four walls maintains uniform heat from the door to the back wall.

Stanley Flexible-Shaft Grinder

A flexible - shaft, portable grinder that develops $\frac{3}{8}$ horsepower and a speed of 1800 revolutions per minute has been placed on the market by the Stanley Electric Tool Division, New Britain, Conn. This grinder



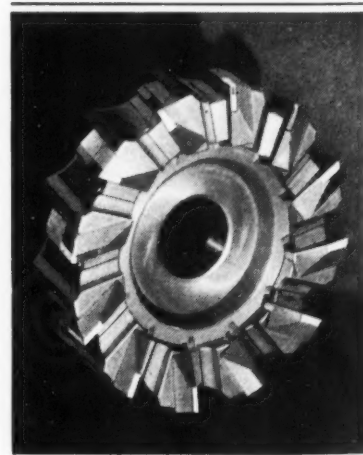
Stanley Flexible-shaft Portable Grinder

can be used for external and internal grinding operations on tools, dies, castings, etc.

The universal motor provides power for driving a $1\frac{1}{2}$ - by $\frac{1}{2}$ -inch emery wheel. The flexible shaft is 42 inches long and has a heavy rubber reinforced casing with protection springs on each end. The handle is equipped with ball bearings and a collet chuck for holding shanks up to $\frac{1}{4}$ inch in diameter. The cradle is designed to hold the motor unit on a bench or to permit it to be suspended overhead.

Ingersoll Zee-Lock Cutters with Cemented-Carbide Blades

Special cutter bodies of the Zee-Lock type have been developed by the Ingersoll Milling Machine Co., Rockford, Ill., for cemented-carbide cutters. The



Zee-Lock Milling Cutter with Cemented-carbide Blades

SHOP EQUIPMENT SECTION

carbide-tipped cutter blades are inserted and locked by the zee-shaped wedges into a forged and case-hardened alloy steel housing. With this construction, the blades are solidly and fully backed up, with no overhang from the body.

The body is relieved in front of the blades, both on the diameter and on the face, to insure adequate chip clearance. Special cutting angles are employed to suit the cemented-carbide cutters. Various grades of cemented carbide are used for different materials or operations. All types of Zee-Lock cutters can be designed for the use of cemented carbide, including face mills, end-mills, side mills, core drills, reamers, hollow mills, and facing heads.

Brown Portable Recording Thermometer

A recording thermometer designed to respond quickly and accurately to changes in temperature of the air in office buildings, cold storage plants, textile mills, or wherever correct atmospheric temperatures must be maintained for comfort or to promote manufacturing efficiency has been developed by the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa.

A permanent temperature record is produced on an 8-inch, 24-hour chart. The mercury-filled bulb is located outside the case of the instrument, as shown in



Brown Portable Recording Thermometer

the illustration, where it is subjected to the natural air currents, and therefore records true temperatures. The bulb is not affected by the temperature of the instrument case, which changes slowly because of the mass of metal it contains. The instrument is built to withstand rough handling.

Cleveland Socket-Wrench Holder

Considerable time is often wasted in looking for tools in the machine shop or tool-room.



Socket-wrench Holder Developed by the Cleveland Universal Jig Company

This is particularly true of special wrenches used for tightening or loosening socket-head set-screws. To prevent time being lost in this manner, the Cleveland Universal Jig Co., 13328 St. Clair Ave., Cleveland, Ohio, recently developed the device here illustrated, which consists of a molded rubber composition base with a separate receptacle for each wrench.

This holder is made in two sizes. The larger size accommodates eleven wrenches, from 3/32 to 5/8 inch across the flats, and is designed for general machine shop use. The smaller holder, designed for toolmakers' use, accommodates eight wrenches in the same range of sizes.



Improved Light Wave Measuring Equipment

Van Keuren Improved Light Wave Equipment

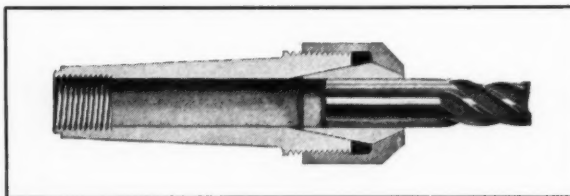
More accurate and longer wearing optical flats and a greatly improved monochromatic light wave equipment recently placed on the market by the Van Keuren Co., 12 Copeland St., Watertown, Mass. This equipment, which is shown in the accompanying illustration, is suitable for testing the flatness of commercially lapped surfaces or for making length or diameter measurements of precision gage-blocks, plug gages, or steel balls.

The optical flat set consists of two single-surface semi-quartz working flats, 2 inches in diameter by 5/8 inch thick, of 0.000002 inch accuracy; one double-surface steel working flat of similar accuracy, 2 inches in diameter by 1/2 inch thick; and one single-surface master flat, 3 inches in diameter by 11/16 inch thick of 0.000001 inch accuracy. The semi-quartz material of the flats shows wearing qualities from three to four times greater than the optical glass formerly used.

The monochromatic light equipment consists of an oak cabinet, 12 inches wide by 11 inches deep by 11 inches high, with space inside for housing the gas-filled tube, the necessary transformer, switch, and diffusing glass. The predominating wave length of the light emitted is so strong that the interference bands are clearly visible when the separation of surfaces is as much as 0.005 inch. Thus the optical flat need not touch the surface being tested.

New "Universal" Collet Chucks

Two collet chucks, one a Type WW, taking shanks from 1/8 to 3/8 inch in diameter, and the other a Type ZZ, taking shanks from 1/2 to 1 inch, have been added to the line of the Universal Engineering Co., Frankenmuth, Mich. The new types are designed to provide an unusually strong gripping power. They are especially adapted for holding end-mills, keyway cutters, drills, and similar tools.



Collet Chuck Added to the Line Made by the Universal Engineering Co.

measuring positions—that is, with the blade projected horizontally, upward, or downward. The blade is manually withdrawn from the case and returned to it, no springs being used for this purpose. It runs smoothly and remains set at any withdrawn length.

Lufkin "Mezurall" Tape-Rule

A 6-foot steel tape-rule known as the "Mezurall" has just been placed on the market by the Lufkin Rule Co., Saginaw, Mich. This tape-rule has a case that is just 2 inches wide, and so in taking an inside measurement, the square back-edge of the case is simply placed against one side of the opening being measured, the blade is extended to the other side, and 2 inches are added to the reading indicated at the opening of the case.

The end hook of this tape-rule has a short sliding action, so that it automatically adjusts itself to give accurate measurements when hooked over any object or when the blade is projected against any surface, as in taking inside measurements. The steel blade will stand upright unsupported like a rule, yet it can be flexed like a tape for measuring round or irregular curves. As the case has three flat edges, it will stand unsupported in three

Houghton Grinding Paste and Soluble Grinding Oil

Two new products for use in precision and mirror-finish grinding have been brought out by E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. These include a grinding paste and a grinding oil, both of which are readily soluble in water. Incorporated in these coolants are materials that lower the surface tension of the water, so that it has a greater cleansing action in washing the chips from the grinding wheel. The chips drop at once into the settling tanks.

The coolants are so treated as to have unusual penetrating properties. They also contain a rust inhibitor which counteracts oxidation and thus prevents rust from forming on the grinding machines or the work. An almost imperceptible film of oil remains on the work, which prevents

atmospheric moisture from coming in contact with the metal.

Greater or less rust preventative properties are obtained by increasing or decreasing the concentration of the solution. The materials remain in solution without gumming or separation, and will

not break down and become rancid. They contain antiseptics that prevent any contamination of the solution from outside sources.

* * *

How Much Does it Cost to Employ a Man?

In an editorial in February MACHINERY, page 378, it was mentioned that according to figures published by the Ford Motor Co., that company spends approximately \$9000 for buildings, machinery, and other expenses for each man employed. In other words, someone must put up \$9000 before somebody else can be put to work helping to build automobiles. The maxim: "Industry should put men to work," is not as simple as it sounds.

The American Iron and Steel Institute has estimated that it requires about \$11,500 of investment for each employe in the steel industry. This represents the cost of providing the employe with a place to work in, with machines and tools to work with, and with materials to work on. This amount of money is roughly divided as follows: \$9000 is required for buildings, machinery, and raw materials; \$1500 for semi-finished and finished materials and supplies; and \$1000 for financing payrolls, taxes, freight, repairs, and replacements.

* * *

Czechoslovakian machine exports in 1935 were the largest on record during the last four years. China was the outstanding market for Czechoslovakian machinery.



"Mezurall" Tape-rule Brought out by the Lufkin Rule Co.

Packaging Machinery Involves Ingenious Features

At the Packaging Exposition, held early in March in New York City, some very remarkable packaging machines were shown in operation. Packaging equipment has been developed to a high degree of perfection during recent years. In the design of machines of this kind, many ingenious mechanisms are used.

A designer of this type of equipment has one advantage over the designer of metal-working equipment—the units are comparatively light and the mechanisms required to perform certain operations can be confined in a comparatively small space, because of the light metal sections used. In many instances, however, extremely high precision of movements is required, because the various mechanisms of the machine must work in perfect synchronism. A difference of a fraction of a second would prevent the perfection now attained in the packages that are used for an endless variety of products.

One of the outstanding events of the exposition was the award of prizes in the All-America Package Competition, sponsored by *Modern Packaging*. In this competition, two prizes were awarded in the machinery group for packaging performed by equipment of ingenious design. One of these machines is used for packing "Knox Jell," made by the Charles B. Knox Gelatine Co.

The cartons to be packed are filled in a satchel-bag packaging machine and pass by means of belt conveyors into a bundling machine that accumulates and bundles a dozen cartons, and wraps and seals them at both ends. As they emerge from a bundling machine on a belt conveyor, an operator places three bundles of twelve cartons each on a shipping container, which moves by gravity to a sealing unit, from which it passes into a printing machine that stamps it with the flavor identification, after which the finished container passes on automatically to the stock-rooms or shipping platforms. The entire sequence of operations is performed automatically, except for placing the bundles in the shipping containers.

Another award in the machinery group was presented to the Emerson Drug Co. in connection with equipment used for filling bottles with Bromo-Seltzer. The filling of the bottles is done by volumetric fillers,

operating at the rate of sixty a minute. The bottles are then capped and labeled, and carried by belt conveyors to a triple cartoning unit, which delivers, in total, some 130,000 cartons a day. The completed cartons travel automatically to the bundling units and from there to the case sealers.

Concerns in the mechanical field that were also presented with awards were the Lamson & Sessions Co., for efficiently constructed and attractive cartons for automotive parts, and the Perfect Circle Co. for fiber containers for piston-rings and automotive parts. The presentation was made at a dinner at which were present, in addition to the recipients of the awards, about 400 representatives of the 145 companies who contributed to the design or making of the winning products, members of the press, and other invited guests.

* * *

General Electric Makes Awards to Forty-Three Employees

Forty-three employees of the General Electric Co. have received the Charles A. Coffin Foundation awards for outstanding achievements during 1935. These awards which comprise a certificate and a cash award, are made for contributions to the progress and prestige of the company and to the advance of the electrical industry. Of the forty-three employees receiving this award, eighteen are factory men, seventeen engineers, six administrative and clerical employees, and two commercial men.

The achievements for which the awards were made relate to a wide variety of work, including factory methods, improvements in engineering and design of products, new engineering methods, electrical inventions, outstanding service to customers, and noteworthy accomplishments in the commercial field.

Among the developments for which awards were made are metal radio receiving tubes, steel-envelope thyatron and phanotron tubes, a new system of highway lighting, high-voltage current transformers of greatly reduced size and weight, and a coordination of current-protective apparatus on distribution systems.

Oil for Hydraulic Transmissions

The Machine Tool Show held in Cleveland last fall indicated the extent to which hydraulic transmissions are now applied to machine tools. To meet the demand for an oil particularly adapted to hydraulic transmissions, the Standard Oil Co. of New Jersey, 26 Broadway, New York City, has developed a lubricating oil having a high viscosity index, which is particularly suitable for a hydraulic medium. Oils previously used as hydraulic mediums usually have had a viscosity index of less than 100, while the newly developed oil has a viscosity index of 153. This oil, it is stated, shows a minimum of change in viscosity with variations in operating temperatures, thereby promoting greater efficiency through reduced internal friction. Leakage is also reduced in the internal parts of the hydraulic transmission mechanism.

* * *

Die-Casting Exhibit in New York

A comprehensive exhibition of die-castings was opened in conjunction with the Metal Products Exhibits, Inc., at the International Building, Rockefeller Center, New York City, on March 16. The exhibit is under the auspices of the American Die Casting Institute, with twenty-seven commercial die-casting firms co-operating. It is planned to continue the exhibition during the month of April.

The exhibition includes not only die-castings, but also complete machines and devices in which die-castings are used to a large extent in the construction. For example, there is a lathe with forty-six die-cast parts. There are also two "home work-shops"—multi-purpose machines with numerous attachments—having a great many of the important parts made from die-castings. Parts die-cast from zinc, aluminum, and magnesium are on exhibition. The versatility of the die-casting process could not be better demonstrated. Almost every activity of life is represented, from toys to automobile parts, and from medical equipment to metal-working machinery. The exhibit covers a multitude of household devices, office equipment, vending machines, and novelties of various kinds.

NEWS OF THE INDUSTRY

Connecticut

CARL W. BETTCHER has been elected vice-president of the Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven, Conn., manufacturer of the H & G self-opening die-heads and chasers. Mr. Bettcher has been connected with this company for the last seventeen years.

FARREL-BIRMINGHAM Co., Inc., Ansonia, Conn., at the annual meeting of the board of directors, re-elected FRANKLIN FARREL, JR., chairman of the board of directors, and NELSON W. PICKERING, president.

Illinois

SUNDSTRAND MACHINE TOOL Co., 2530 Eleventh St., Rockford, Ill., has acquired the AMERICAN BROACH & MACHINE Co., of Ann Arbor, Mich. FRANCIS J. LAPOINTE, formerly president of the latter company, has been named a vice-president and a member of the board of directors of the Sundstrand Machine Tool Co. D. A. DELONG, formerly secretary of the American Broach & Machine Co., has been elected assistant treasurer of the Sundstrand Machine Tool Co. The other officers are: HUGO L. OLSON, president and general manager; LEVIN FAUST, vice-president; GEORGE A. LINDBLADE, secretary and treasurer; and GUST H. EKSTROM, assistant secretary and treasurer.

ALEMITE DIVISION OF STEWART-WARNER CORPORATION, Chicago, Ill., announces an expansion of its manufacturing activities to include the production of oiling devices. First to be introduced are two types of oil-cups combining the best principles of sight-feed oilers with some distinctly new features.

Michigan and Wisconsin

DETROIT GRAY IRON FOUNDRY Co., Detroit, Mich., on March 14, formally opened a new unit for the production of "Lektrokast," a new electric-furnace iron. To this opening, customers and friends of the company, members of the technical press, and interested engineers were invited. The new large electric furnace used in the making of Lektrokast is housed in a completely new building with approximately 15,000 square feet of floor space. Lektrokast is suitable for all purposes for which a

high-grade electric-furnace iron would be used, including the better type of castings for dies.

HUTTON H. HALEY & ASSOCIATES, 2832 E. Grand Blvd., Detroit, Mich., have been appointed exclusive agents in the Detroit territory for Kling heavy-duty grinders by the BRYANT MACHINERY & ENGINEERING Co., 400 W. Madison St., Chicago, Ill., national distributor for this line. Kling grinders are manufactured by KLING BROS. ENGINEERING WORKS, Chicago, especially for use in snagging operations in foundries and similar heavy grinding operations.

KOEBEL DIAMOND TOOL Co., Detroit, Mich., manufacturer of Koebel diamond wheel-dressing tools, has completed the installation of machinery in an additional plant building adjacent to its present quarters at 1200 Oakman Blvd. in Detroit.

WROUGHT WASHER MFG. Co., Milwaukee, Wis., has introduced a complete line of non-ferrous expansion plugs including brass, copper, aluminum, stainless steel, and Monel metal. For this purpose, the company has increased its manufacturing facilities and has installed extensive tool equipment for producing the complete range of sizes required by industry today.

A. D. BROWN has been appointed manager of the Los Angeles district office of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., to fill the vacancy caused by the sudden death of Boyd Anderson. H. E. WEISS has been appointed manager of the company's Buffalo district office, succeeding Mr. Brown.

New York and New Jersey

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y., announces that the firm will conduct two training courses in metal radiography at its laboratory during the coming summer. One of the courses will be held during the week of July 6, immediately after the annual meeting of the American Society for Testing Materials, and the other during the week of July 13. Further information can be obtained from the St. John X-Ray Service, Inc.

CHARLES A. MOORE, chairman of the board of Manning, Maxwell & Moore, New York City, was elected chairman of the Electric Hoist Manufacturers' Association at the nineteenth annual meeting recently held in Chicago, Ill. Shaw-

Box Crane & Hoist Co., a member of the Association, is a subsidiary of Manning, Maxwell & Moore. A. S. WATSON, vice-president of the Detroit Hoist & Machine Co., Detroit, Mich., was elected vice-chairman of the Association.

PRATT INDUSTRIES, INC., has taken over the entire business of the PRATT CHUCK Co., of Frankfort, N. Y., and will operate from the same offices and plant. WINTHROP T. SCARRITT is president and treasurer of the new organization; GEORGE SICARD, vice-president and director of sales; and ALEXANDER PIRNIE, secretary. The products manufactured by the Pratt Chuck Co. include electrical goods, automobile mufflers, chucks, and stampings.

NATIONAL AUTOMATIC TOOL Co., Richmond, Ind., manufacturer of Natco drilling, boring, and tapping machines, has appointed R. S. BROWN eastern sales representative, with headquarters in New York City. Mr. Brown has been with the Natco sales organization at the home office in Richmond, Ind., for several years. He succeeds C. H. BRIGGS who has become manager of the Syracuse office of Henry Prentiss & Co., machinery dealers.

J. D. WRIGHT and KARL H. RUNKLE have been appointed assistant managers of the industrial department of the General Electric Co., Schenectady, N. Y. Prior to their promotion, Mr. Wright was assistant head of the industrial department's engineering staff and Mr. Runkle was manager of sales of the mining and steel mill section.

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City, has appointed H. L. GEIGER, Room 1116, 333 N. Michigan Ave., Chicago, Ill., field representative in the Chicago district, and A. G. ZIMA, 705 Petroleum Securities Bldg., Olympic and Flower Sts., Los Angeles, Calif., representative on the West Coast.

AMERICAN BRAKE SHOE & FOUNDRY Co., has added to its research facilities a new engineering and research laboratory named in honor of F. W. Sargent—the "father of brake-shoe engineering." This laboratory is considered the most completely equipped brake-shoe testing laboratory in the world. It is located at Mahwah, N. J., and is known as the Sargent Research Laboratory.

Ohio

CYRIL GRINDROD, for the last ten years general foreman in charge of the automatic screw machine, gear-cutting, and sheet-metal departments of the Dalton-Powers Division, Remington Rand Corporation, Norwood, Ohio, has joined the Union Drawn Steel Co., Massillon, Ohio, as sales engineer and consultant to the trade on automatic screw machine oper-